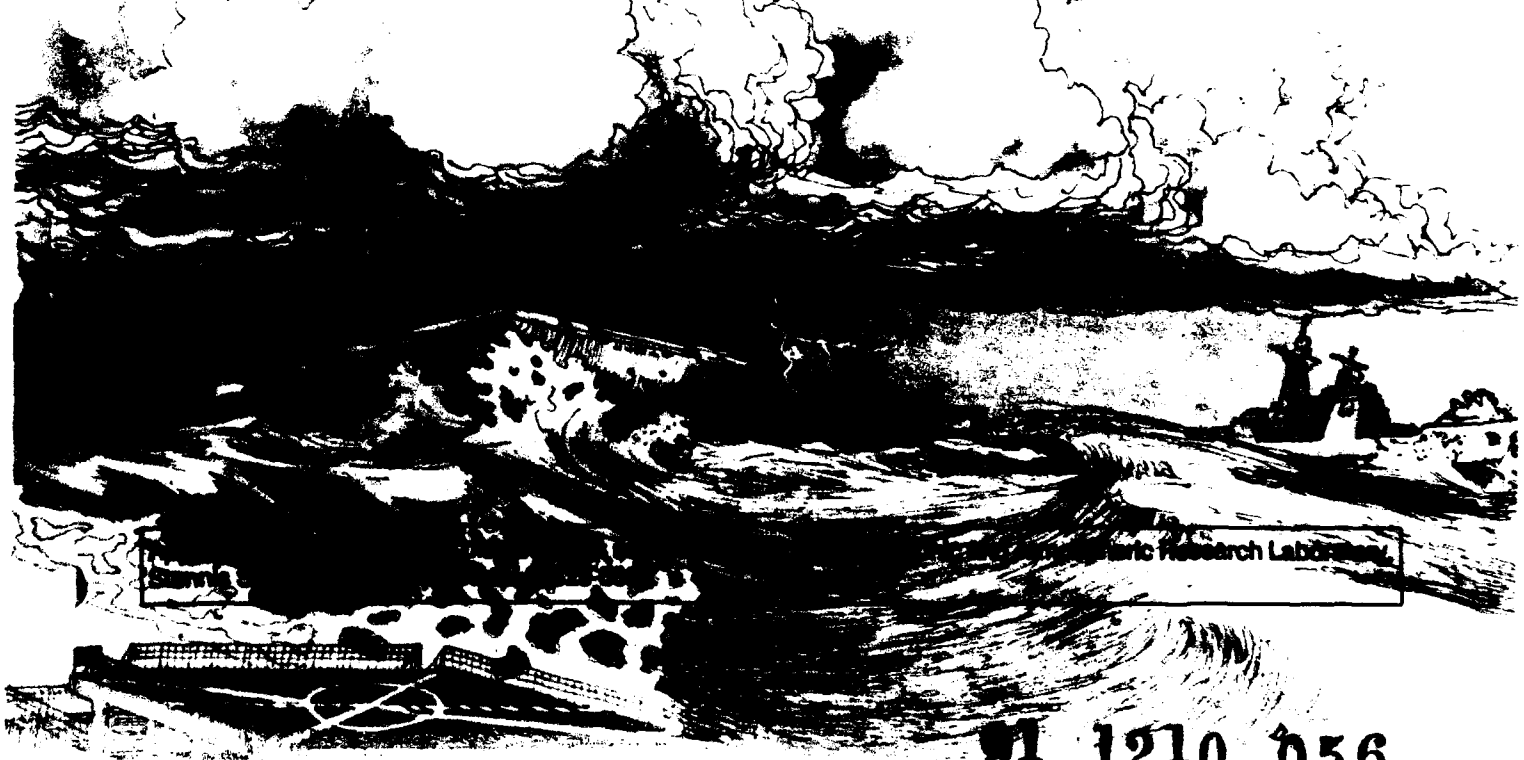
Naval Oceanographic and
Atmospheric Research Laboratory

Technical Note 113
June 1991

SEVERE WEATHER GUIDE MEDITERRANEAN PORTS

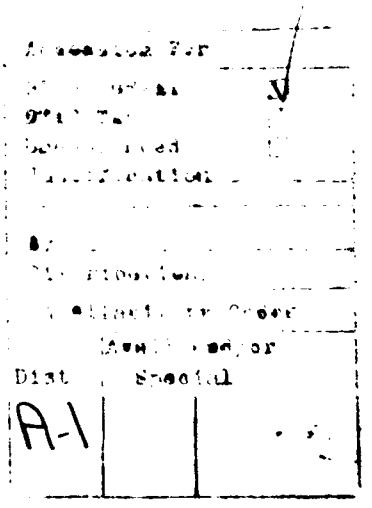
37. LARNACA



These working papers were prepared for the timely dissemination of information; this document does not represent the official position of NOARL.

ABSTRACT

This handbook for the port of Larnaca, Cyprus, one in a series of severe weather guides for Mediterranean ports, provides decision-making guidance for ship captains whose vessels are threatened by actual or forecast strong winds, high seas, restricted visibility or thunderstorms in the port vicinity. Causes and effects of such hazardous conditions are discussed. Precautionary or evasive actions are suggested for various vessel situations. The handbook is organized in four sections for ready reference: general guidance on handbook content and use; a quick-look captain's summary; a more detailed review of general information on environmental conditions; and an appendix that provides oceanographic information.



ACKNOWLEDGMENTS

The support of the sponsors - Naval Oceanography Command, Stennis Space Center, MS: and Fleet Numerical Oceanography Center, Monterey, CA (Program Element O&M,N) - is gratefully acknowledged.

CONTENTS

FOREWORD

This handbook on Mediterranean Ports was developed as part of an ongoing effort at the Atmospheric Directorate, Naval Oceanographic and Atmospheric Laboratory (NOARL), Monterey, to create products for direct application to Fleet Operations. The research was conducted in response to Commander Naval Oceanography Command (COMNAVOCEANCOM) requirements validated by the Chief of Naval Operations (OP-096).

As mentioned in the preface, the Mediterranean region is unique in that several areas exist where local winds can cause dangerous operating conditions. This handbook will provide the ship's captain with assistance in making decisions regarding the disposition of his ship when heavy winds and seas are encountered or forecast at various port locations.

Readers are urged to submit comments, suggestions for changes, deletions and/or additions to Naval Oceanography Command Center (NAVOCEANCOMCEN), Rota with a copy to the oceanographer, COMSIXTHFLT. They will then be passed on to NOARL, Monterey for review and incorporation as appropriate. This document will be a dynamic one, changing and improving as more and better information is obtained.

PORT INDEX

The following is a tentative prioritized list of Mediterranean Ports to be evaluated during the five-year period 1988-92, with ports grouped by expected year of the port study's publication. This list is subject to change as dictated by circumstances and periodic review. Computerized versions of these port guides are available for those ports with an asterisk (*). Contact the Atmospheric Directorate, NOARL, Monterey or NOCC Rota for IBM compatable floppy disk copies.

NO.	PORT
*1	GAETA, ITALY
*2	NAPLES, ITALY
*3	CATANIA, ITALY
*4	AUGUSTA BAY, ITALY
*5	CAGLIARI, ITALY
*6	LA MADDALENA, ITALY
7	MARSEILLE, FRANCE
8	TOULON, FRANCE
9	VILLEFRANCHE, FRANCE
10	MALAGA, SPAIN
11	NICE, FRANCE
12	CANNES, FRANCE
13	MONACO
14	ASHDOD, ISRAEL
15	HAIFA, ISRAEL
16	BARCELONA, SPAIN
17	PALMA, SPAIN
18	IBIZA, SPAIN
19	POLLENSA BAY, SPAIN
20	LIVORNO, ITALY
21	LA SPEZIA, ITALY
22	VENICE, ITALY
23	TRIESTE, ITALY
*24	CARTAGENA, SPAIN
*25	VALENCIA, SPAIN
*26	SAN REMO, ITALY
*27	GENOA, ITALY
*28	PORTO TORRES, ITALY
*29	PALERMO, ITALY
*30	MESSINA, ITALY
*31	TAORMINA, ITALY
*32	TARANTO, ITALY
*33	TANGIER, MOROCCO
*34	BENIDORM, SPAIN
*35	ROTA, SPAIN
*36	LIMASSOL, CYPRUS
*37	LARNACA, CYPRUS
*38	ALEXANDRIA, EGYPT
*39	PORT SAID, EGYPT
40	BIZERTE, TUNISIA
41	TUNIS, TUNISIA
42	SOUSSE, TUNISIA
43	SFAX, TUNISIA
44	SOUDA BAY, CRETE

1991 PORT
VALETTA, MALTA
PIRAEUS, GREECE

1992 PORT
KALAMATA, GREECE
CORFU, GREECE
KITHIRA, GREECE
THESSALONIKI, GREECE

DELAYED INDEFINITELY
ALGIERS, ALGERIA
ISKENDERUN, TURKEY
IZMIR, TURKEY
ISTANBUL, TURKEY
ANTALYA, TURKEY
GOLCUK, TURKEY

PREFACE

Environmental phenomena such as strong winds, high waves, restrictions to visibility and thunderstorms can be hazardous to critical Fleet operations. The cause and effect of several of these phenomena are unique to the Mediterranean region and some prior knowledge of their characteristics would be helpful to ship's captains. The intent of this publication is to provide guidance to the captains for assistance in decision making.

The Mediterranean Sea region is an area where complicated topographical features influence weather patterns. Katabatic winds will flow through restricted mountain gaps or valleys and, as a result of the venturi effect, strengthen to storm intensity in a short period of time. As these winds exit and flow over port regions and coastal areas, anchored ships with large 'sail areas' may be blown aground. Also, hazardous sea state conditions are created, posing a danger for small boats ferrying personnel to and from port. At the same time, adjacent areas may be relatively calm. A glance at current weather charts may not always reveal the causes for these local effects which vary drastically from point to point.

Because of the irregular coast line and numerous islands in the Mediterranean, swell can be refracted around such barriers and come from directions which vary greatly with the wind. Anchored ships may experience winds and seas from one direction and swell from a different direction. These conditions can be extremely hazardous for tendered vessels. Moderate to heavy swell may also propagate outward in advance of a storm resulting in uncomfortable and sometimes dangerous conditions, especially during tending, refueling and boating operations.

This handbook addresses the various weather conditions, their local cause and effect and suggests some evasive action to be taken if necessary. Most of the major ports in the Mediterranean will be covered in the handbook. A priority list, established by the Sixth Fleet, exists for the port studies conducted and this list will be followed as closely as possible in terms of scheduling publications.

RECORD OF CHANGES

CHANGE NUMBER	DATE OF CHANGE	DATE ENTERED	PAGE NUMBER	ENTERED BY

1. GENERAL GUIDANCE

1.1 DESIGN

This handbook is designed to provide ship captains with a ready reference on hazardous weather and wave conditions in selected Mediterranean harbors. Section 2, the captain's summary, is an abbreviated version of section 3, the general information section intended for staff planners and meteorologists. Once section 3 has been read, it is not necessary to read section 2.

1.1.1 Objectives

The basic objective is to provide ship captains with a concise reference of hazards to ship activities that are caused by environmental conditions in various Mediterranean harbors, and to offer suggestions for precautionary and/or evasive actions. A secondary objective is to provide adequate background information on such hazards so that operational forecasters, or other interested parties, can quickly gain the local knowledge that is necessary to ensure high quality forecasts.

1.1.2 Approach

Information on harbor conditions and hazards was accumulated in the following manner:

A. A literature search for reference material was performed.
B. Cruise reports were reviewed.
C. Navy personnel with current or previous area experience were interviewed.
D. A preliminary report was developed which included questions on various local conditions in specific harbors.
E. Port/harbor visits were made by NOARLW personnel; considerable information was obtained through interviews with local pilots, tug masters, etc; and local reference material was obtained.
F. The cumulative information was reviewed, combined, and condensed for harbor studies.

1.1.3 Organization

The Handbook contains two sections for each harbor. The first section summarizes harbor conditions and is intended for use as a quick reference by ship captains, navigators, inport/at sea OOD's, and other interested personnel. This section contains:

A. a brief narrative summary of environmental hazards,
B. a table display of vessel location/situation, potential environmental hazard, effect-precautionary/evasion actions, and advance indicators of potential environmental hazards,
C. local wind wave conditions, and
D. tables depicting the wave conditions resulting from propagation of deep water swell into the harbor.

The swell propagation information includes percent occurrence, average duration, and the period of maximum wave energy within height ranges of greater than 3.3 feet and greater than 6.6 feet. The details on the generation of sea and swell information are provided in Appendix A.

The second section contains additional details and background information on seasonal hazardous conditions. This section is directed to personnel who have a need for additional insights on environmental hazards and related weather events.

1.2 CONTENTS OF SPECIFIC HARBOR STUDIES

This handbook specifically addresses potential wind and wave related hazards to ships operating in various Mediterranean ports utilized by the U.S. Navy. It does not contain general purpose climatology and/or comprehensive forecast rules for weather conditions of a more benign nature.

The contents are intended for use in both previsit planning and in situ problem solving by either mariners or environmentalists. Potential hazards related to both weather and waves are addressed. The

oceanographic information includes some rather unique information relating to deep water swell propagating into harbor shallow water areas.

Emphasis is placed on the hazards related to wind, wind waves, and the propagation of deep water swell into the harbor areas. Various vessel locations/situations are considered, including moored, nesting, anchored, arriving/departing, and small boat operations. The potential problems and suggested pre-cautionary/evasive actions for various combinations of environmental threats and vessel location/situation are provided. Local indicators of environmental hazards and possible evasion techniques are summarized for various scenarios.

CAUTIONARY NOTE: In September 1985 Hurricane Gloria raked the Norfolk, VA area while several US Navy ships were anchored on the muddy bottom of Chesapeake Bay. One important fact was revealed during this incident: Most all ships frigate size and larger dragged anchor, some more than others, in winds of over 50 knots. As winds and waves increased, ships 'fell into' the wave troughs, BROADSIDE TO THE WIND and become difficult or impossible to control.

This was a rare instance in which several ships of recent design were exposed to the same storm and much effort was put into the documentation of lessons learned. Chief among these was the suggestion to evade at sea rather than remain anchored at port whenever winds of such intensity were forecast.

2. CAPTAIN'S SUMMARY

The Port of Larnaca is located on the southeast coast of the island of Cyprus in the eastern Mediterranean Sea at approximately 35°56'N 33°39'E (Figure 2-1).

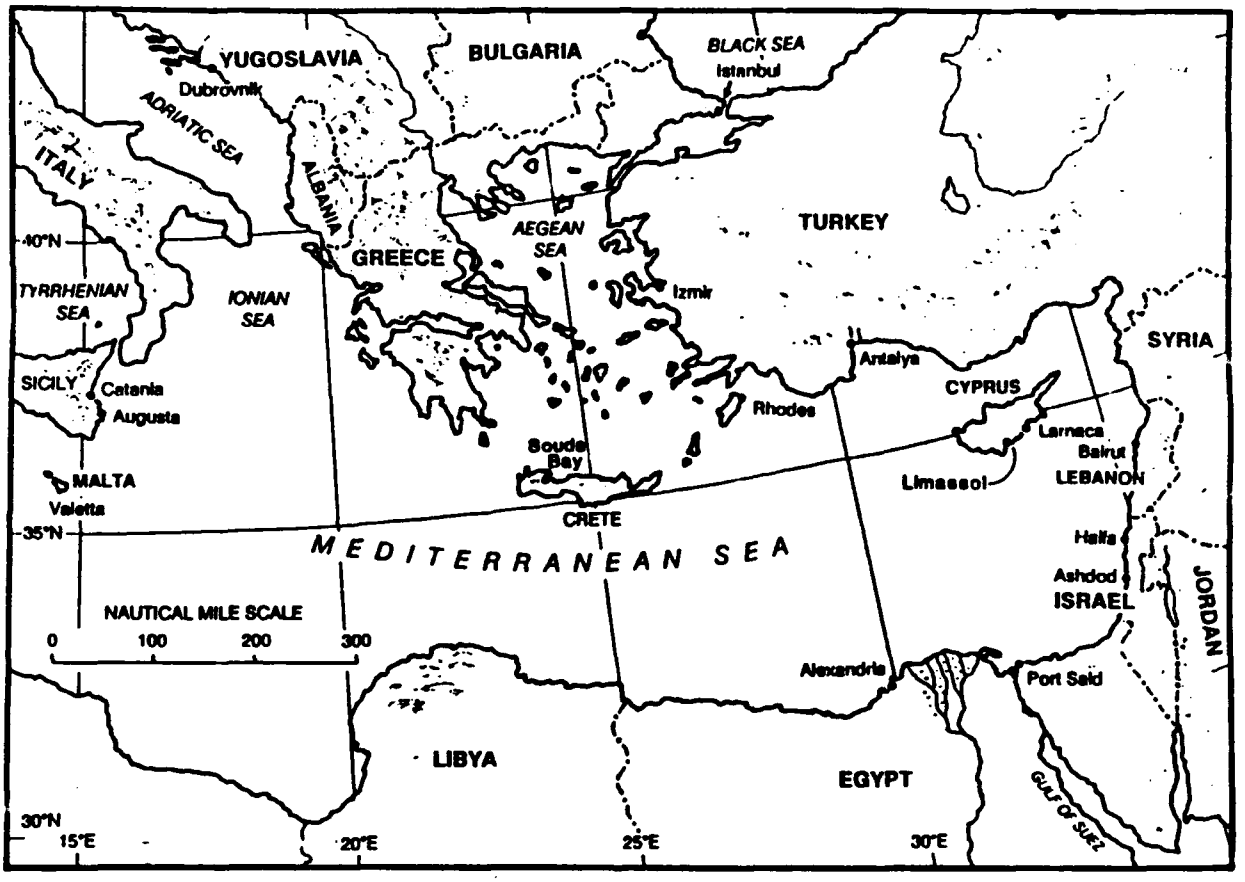


Figure 2-1. Eastern Mediterranean Sea.

The port is situated about 12 n mi west of Cape Greco and 7 n mi north-northeast of Cape Kiti (Figure 2-2). Cyprus is largely mountainous, with the Troodos Mountains in the west central portion of the island having the highest elevation, Mount Olympus, which reaches 6,404 ft (1,952 m) about 38 n mi west of the port. The Kyrenia Range extends east-west along the north coast of the island, with elevations over 2,953 ft (900 m) occurring in several areas. The highest elevation near Larnaca is a peak of 2,011 ft (613 m) situated some 14 n mi west. Low lying salt pans exist near the coast south-southwest of the port. (Figure 2.2)

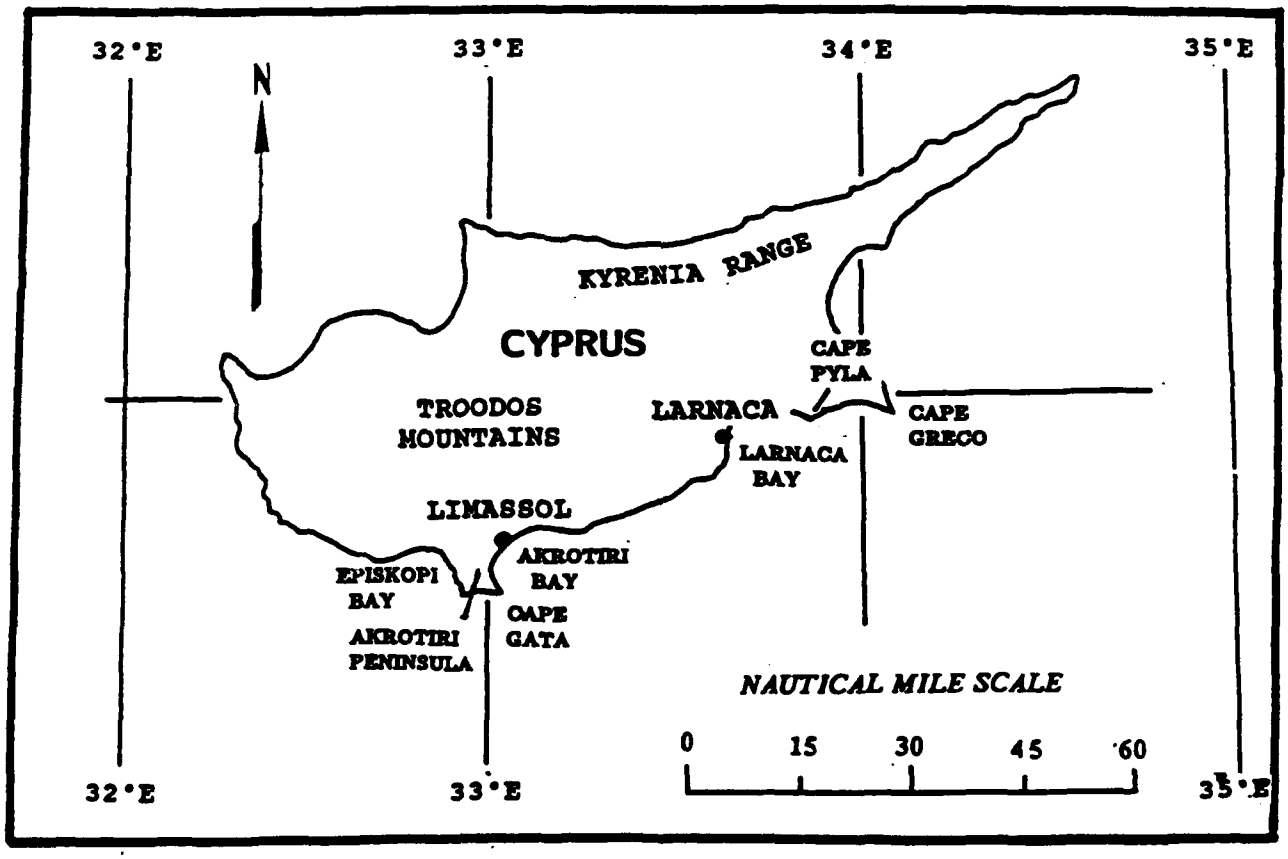


Figure 2-2. Cyprus.

The Port of Larnaca is located on Larnaca Bay (Figure 2-3). The port is composed of two sections: an older, smaller harbor with limited facilities, and a newer, larger harbor which can accommodate larger vessels. It is the newer harbor which is of interest to this study. It is located north of the smaller facility, and is entered between two breakwaters. The channel of the approach to the new harbor is dredged to a depth of 31 ft (9.4 m) and has a maximum width of 350 ft (106.7 m) at the entrance (FICEURLANT, 1984). (Figure 2-3)

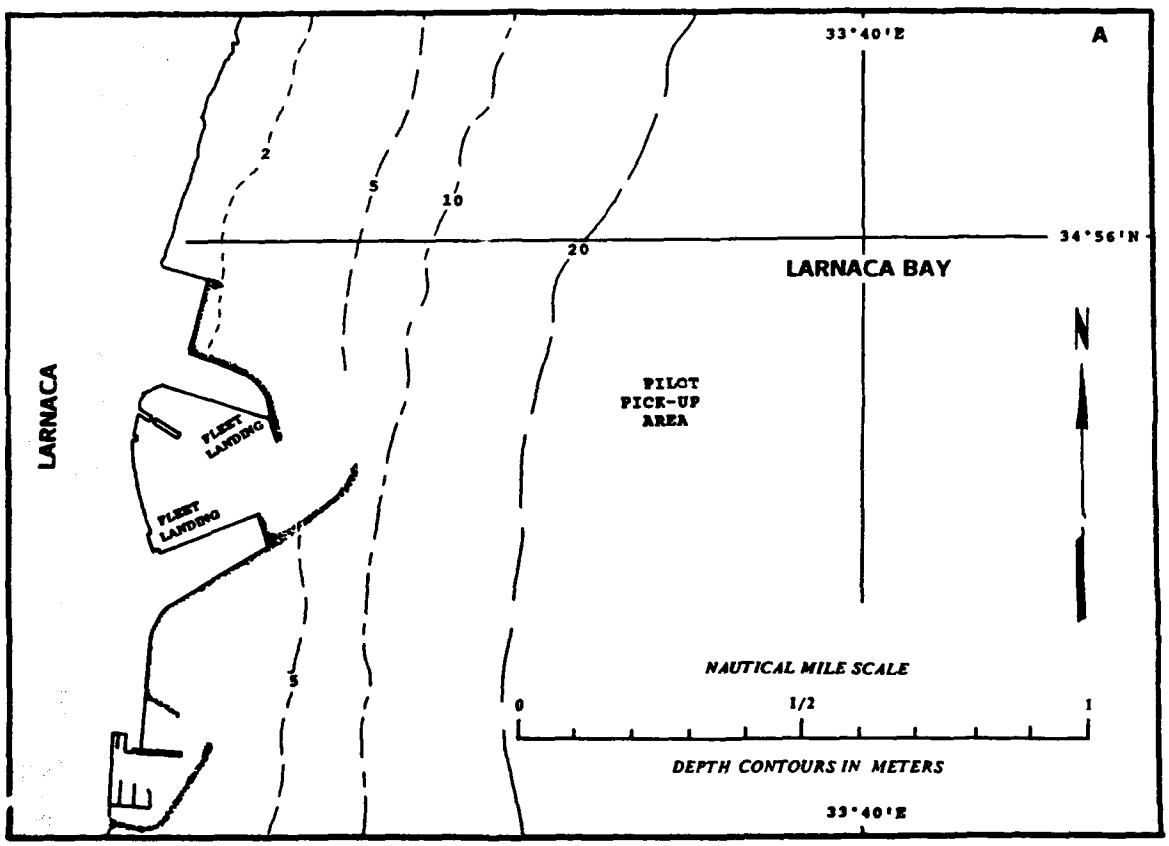


Figure 2-3. Port of Larnaca.

The largest berth in the harbor can accommodate vessels to 660 ft (201 m) in length which draw no more than 31 ft (9.4 m) of water. Smaller ships (less than 328 ft (100 m) long) can berth at the central pier. Fleet landings have been established at two locations in the harbor and are indicated on Figure 3-3. The northeast landing has a 5.25 ft (1.6m) ramp height, while the southwest landing has a ramp height of 3 ft (0.9 m).

Local port authorities said an anchorage for aircraft carriers is located 1.5 n mi northeast (060° true) from the north end of the east breakwater of the new harbor (indicated by the letter A on Figure 3-3). Good holding on a sand and weed bottom is provided. FICEURLANT (1984) specifies that "Tankers awaiting a berth should anchor north of 34-56N. Cargo and passenger vessels should anchor south of a line drawn 90 degrees [due east] from the head of the south breakwater of the main harbor. Anchoring is prohibited in the area between these two lines to a distance of 2.8 kilometers (1.75 miles) from the coast."

Tides are limited to about 1 ft (30 cm). Currents vary according to prevailing winds. A wind of 22-33 kt (force 6-7) can generate a 0.5 to 0.8 kt current.

Specific hazardous conditions, vessel situations, and suggested precautionary/evasive action scenarios are summarized in Table 2-1.

Table 2-1. Summary of hazardous environmental co

HAZARDOUS CONDITION	INDICATORS OF POTENTIAL HAZARDS	S
1. <u>NE-SE winds and waves</u> - Creates the worst weather conditions at the port. * Strongest and most likely to occur during November-April period. * Daytime wind speeds are usually in the 17-27 kt range, decreasing to 7-16 kt at night. * Swell heights at anchorage may reach 10-14 ft (3-4 m). * Swell heights in inner harbor are limited to about 3 ft (1 m).	<u>Advance warning</u>. * Existing or building high pressure over Turkey and coincident low pressure to the S near Egypt. <u>Duration</u>. * Swell at anchorage may last 2-3 days.	

tidous environmental conditions for the Port of Larnaca, Cyprus.

S:TORS OF U/. HAZARDS	VESSEL LOCATION/ SITUATION AFFECTED	EFFECT - PRECAUTIONARY/EVASIVE ACTIONS
) ! rb: building high :r Turkey and .ow pressure to :gypt. :horage may last	(1) Moored - inner harbor.	(a) Little effect on ships moored in inner harbor. * The north-facing harbor entrance and rocks lining the harbor entrance whic.. absorb much of the energy of the wave motion outside the breakwaters, results in a maximum swell height of about 3 ft (1 m) in the harbor. * The harbor offers little protection from wind. * Crews of moored vessels should stay in contact with the Larnaca Meteorological office at the airport to see if strong winds are expected and double/add mooring lines as required. * Sortie to avoid high winds should not be necessary.
)	(2) Anchored.	(a) WORST CONDITIONS FOR THE ANCHORAGE. * The anchorage is safe throughout the year for vessels having good ground tackle, but the short period sea and heavy swell generated by SE gales makes it uncomfortable at times. * Ships have never had to leave the anchorage due to bad weather. * Cape Pyla, approximately 10 n mi E of the port would provide better shelter from E'ly winds and swell. * If the wind is SE, better conditions can be found near shore W of Cape Kiti, about 7 n mi S of the port. * Anchor dragging is possible with winds of 22 kt or greater, especially for vessels with large sail area. * S and SE gales usually shift to SW and if vessels drag, they usually do so parallel to the shore.

HAZARDOUS CONDITION	INDICATORS OF POTENTIAL HAZARDS
2. Bora winds - W to NW winds which may extend out of the Aegean Sea to the Cyprus area. * Strongest in winter and early spring, uncommon in summer and early autumn. * Direction is W near Cyprus. * Little effect on ships in port, but may affect arriving/departing vessels.	Advance warning. * Cold air invasion of Aegean Sea which exceeds 5,000 ft in depth. If the depth is less than 5,000 ft, Bora winds will not reach the E Mediterranean area.

ed) **Table 2-1. (continued)**

/ES ITU ORS OF HAZARDS	VESSEL LOCATION/ SITUATION AFFECTED	EFFECT - PRECAUTIONARY/EVASIVE ACTIONS
(3 de	(3) Arriving/ departing.	(a) WORST CONDITIONS FOR THE PORT, BUT IT HAS NEVER BEEN CLOSED DUE TO BAD WEATHER, EVEN WITH WINDS OF GALE FORCE (34 KT, FORCE 8) OR MORE. * Although the inner harbor is not significantly affected, the anchorage and open sea areas surrounding Larnaca are exposed to the full force of the winds and waves. * The anchorage is safe throughout the year for vessels having good ground tackle, but the short period sea and heavy swell generated by SE gales makes it uncomfortable at times. * Ships have never had to leave the anchorage due to bad weather. * Cape Pyla, approximately 10 n mi E of the port would provide better shelter from E'ly winds and swell. * Inbound vessels should be aware that anchor dragging is possible with winds of 22 kt or greater, especially for vessels with large sail area. * S and SE gales usually shift to SW and if vessels drag, they usually do so parallel to the shore. * Pilot boats continue to operate in winds up to gale force (34 kt, force 8).
(4 op	(4) Small Boat operations.	(a) Small boat operations continue until wind speed reaches 22 kt or more.
(1 ha vasion of Aegean xceeds 5,000 ft If the depth is	(1) Moored - inner harbor.	(a) Little effect.
(2 ,000 ft, Bora ıot reach the E ın area.	(2) Anchored.	(a) Little effect.
(3 de	(3) Arriving/ departing.	(a) Little effect in the port area, but arriving/departing ships will likely experience increased wind velocities and wave heights when clear of the protection of Cyprus.
(4 ope	(4) Small Boat operations.	(a) Little effect.

HAZARDOUS CONDITION	INDICATORS OF POTENTIAL HAZARDS
3. Scirocco event - Warm SE to SW wind which reaches the Cyprus area from N Africa. * Strongest in winter and early spring, uncommon in summer and early autumn. * Although not mentioned as a hazard by local authorities, swell may reach the anchorage. * Associated weather may include low stratus, fog and drizzle with reduced visibility. * Heavy rain is likely near frontal boundaries and topographical barriers such as the mountains of Cyprus.	Advance warning. * Usually found E of cyclones that develop either over the S Aegean Sea/Sea of Crete or near Cyprus. * Strong S'ly winds at stations along the NE coast of Libya may indicate Scirocco onset.
4. Cyprus depression - Most intense during November-April period. * Associated weather includes strong-to-gale force, squally winds with heavy showers.	Advance warning. * Decreasing atmospheric pressure over the area between the Gulf of Antalya and Cyprus. * Cyclones also form over the S Aegean Sea and Sea of Crete. If one forms along the leading edge of a significant surge of cold air, it may move to the Cyprus area.

ued) Table 2-1. (continued)

VE RS OF SIT HAZARDS	VESSEL LOCATION/ SITUATION AFFECTED	EFFECT - PRECAUTIONARY/EVASIVE ACTIONS
(1) ha E of cyclones either over the Sea of Crete or inds at g the NE coast indicate t.	(1) Moored - inner harbor.	(a) Little effect. * Crews of moored vessels should stay in contact with the Larnaca Meteorological Office at the airport to see if strong winds are expected and double/add mooring lines as required. * Extremely anomalous radar and radio propagation may be experienced due to a strong low level inversion.
(2	(2) Anchored.	(a) Little effect. * A steady wind of 20 kt could raise 8 ft waves in the anchorage. * Extremely anomalous radar and radio propagation may be experienced due to a strong low level inversion.
(3 de	(3) Arriving/ departing.	(a) Little effect in the port. * Minimal impact on the inner harbor. * A steady wind of 20 kt could raise waves to 8 ft in the anchorage but should pose no problem for arriving or departing units. * Extremely anomalous radar and radio propagation may be experienced. * Pilot boats from the port operate until winds increase to gale force (34 kt, force 8).
(4 op	(4) Small Boat operations.	(a) Small boat operations normally continue until wind reaches 22 kt (force 6).
(1 ha ospheric the area	(1) Moored - inner harbor.	(a) Little effect. * Crews should be prepared for strong, gusty winds and heavy showers.
(2 lf of Antalya form over the nd Sea of forms along ge of a rge of cold ve to the	(2) Anchored.	(a) Little effect, unless wind direction is S or SW. * Winds of 22 kt or greater could cause anchor dragging. * Crews should be prepared for strong, gusty winds and heavy showers.
(3 de	(3) Arriving/ departing.	(a) Little significant effect. * Incoming vessels should be aware that winds of 22 kt or greater could cause anchor dragging. * Crews should be prepared for strong, gusty winds and heavy showers, with heavier weather to be expected when clear of the protection of Cyprus. * Arriving vessels should be aware that pilot boats from the port operate until winds increase to gale force (34 kt, force 8).
(4 op	(4) Small Boat operations.	(a) Little significant effect. * Small boat operations normally continue until wind force reaches 22 kt (force 6).

Table 2-1. (continued)

HAZARDOUS CONDITION	INDICATORS OF POTENTIAL HAZARDS	VES SITU
5. Etesian winds - Direction near Cyprus may be from W to N. * Primarily a summer event. * Port area is protected from significant wind by topography of island. * Increased winds and seas may be encountered S of Cape Kiti by arriving/departing units.	Advance warning. * If strong N to NW'ly flow occurs over the Aegean Sea, Etesian winds may reach the Cyprus area.	(1) har (2) (3) dep (4) ope

2-1. (continued)

EL LO TION	S OF AZARDS	VESSEL LOCATION/ SITUATION AFFECTED	EFFECT - PRECAUTIONARY/EVASIVE ACTIONS
pored t. nchor	NW'ly flow Aegean Sea, ay reach the	(1) Moored - inner harbor.	(a) Little significant effect since the port is protected from W'ly winds by the topography of the island.
		(2) Anchored.	(a) Little significant effect since the port is protected from W'ly winds by the topography of the island.
rivi ing.		(3) Arriving/ departing.	(a) Little significant effect in the port. * Open ocean conditions S of the port would be exposed to winds and waves created by the etesian event. Departing vessels should expect heavier weather when clear of the protection of Cyprus. * Arriving vessels should we aware that pilot boats from the port operate until winds increase to gale force (34 kt, force 8).
mall tions		(4) Small Boat operations.	(a) Little significant effect. * Small boat operations normally continue until wind force reaches 22 kt (force 6). * Port is well protected by topography, so impact on small boat operations should be minimal.

Table 2-1.

HAZARDOUS CONDITION	INDICATORS OF POTENTIAL HAZARDS
6. <u>N African cyclones</u> - Develop over N Africa, causing warm S'ly winds over E Mediterranean Sea. * Most common in spring. May occur in winter and autumn but is uncommon in summer. * Biggest problems for the port are the Scirocco conditions (see section 3. above) which may develop ahead of the low pressure system.	<u>Advance warning</u>. * Difficult to ascertain due to scarcity of timely surface weather reports over N Africa.

ntinu **Table 2-1. (continued)**

VESSI ITUA	ORS OF HAZARDS	VESSEL LOCATION/ SITUATION AFFECTED	EFFECT - PRECAUTIONARY/EVASIVE ACTIONS
(1) harb	ascertain due f timely er reports over	(1) Moored - inner harbor.	(a) Minimal effect. * Inner harbor is well protected from waves. * Vessels should stay in contact with Larnaca Meteorological Office at the airport to see if strong winds are expected, and double/add mooring lines as required. * Extremely anomalous radar and radio propagation may be experienced due to a strong low level inversion.
(2)		(2) Anchored.	(a) Minimal effect. * Unless event brings stronger than normal winds to the anchorage, no significant problems should be experienced. Vessels should maintain contact with Larnaca Meteorological Officer at the airport to see if strong winds are expected. * If wind is SW, anchor dragging could occur in a strong event. * Sustained S winds of 20 kt could raise waves to 8 ft in the anchorage, but should pose no significant problem for anchored ships. * Anomalous radar and radio propagation may be experienced.
(3) depa		(3) Arriving/ departing.	(a) Minimal effect. * Unless event brings stronger than normal winds to the anchorage, no significant problems should be experienced. * Sustained S winds of 20 kt could raise waves to 8 ft in the anchorage, but the inner harbor will be largely unaffected. * Anomalous radar and radio propagation may be experienced. * Arriving vessels should be aware that pilot boats operate until winds increase to gale force (34 kt, force 8).
(4) oper		(4) Small Boat operations.	(a) Small boat operations normally continue until wind force reaches 22 kt (force 6).

SEASONAL SUMMARY OF HAZARDOUS WEATHER CONDITIONS

WINTER (November through February):

* Northeast to southeast winds and waves bring worst weather to the port. Winds of 7-16 kt (force 3-4) at night increasing to 17-27 kt (force 5-6) during daytime create waves of 10 to 14 ft (3-4 m) at the anchorage that last for 2-3 days. The inner harbor is protected from most waves, with maximum swell height inside the entrance being about 3 ft (1 m).
* Bora. A Bora is a cold wind originating in the Aegean Sea which may reach the eastern Mediterranean Sea. Direction is west-northwesterly in the eastern Mediterranean and westerly just south of Larnaca. Convective clouds and shower activity normally accompany Bora conditions.
* Scirocco. Southeast to southwesterly winds. Warm in winter. May be accompanied by low stratus, fog, and drizzle with low visibility. Anomalous radar and radio propagation are likely. Heavy rain is possible.
* Cyprus depressions. Usually develop between Cyprus and Turkey. May be accompanied by strong-to-gale force, squally winds with heavy showers. Scirocco conditions may occur ahead of the developing low.

SPRING (March through May)

* Early spring is similar to winter, with Bora, Scirocco, and Cyprus depressions possible.
* North African cyclones are common during spring. Associated weather on Cyprus would be similar to Scirocco conditions.
* Fog may reduce early morning visibility to near zero, clearing by 0800-0900L.

SUMMER (June through September)

* Westerly winds prevail over eastern Mediterranean Sea.
* Settled weather prevails. Precipitation is uncommon.

AUTUMN (October)

* Short transition season with winter-like weather returning by month's end.

The following is a copy of a "Phonecian Wind Prediction Calendar" that was obtained during a visit to the Port of Limassol. It should be applicable to all of Cyprus, and may be of use in anticipating wind events at both Larnaca and Limassol. The calendar is reported to be 90% successful. If wind does not occur, it is late, not absent.

PHONECIAN WIND PREDICTION CALENDAR

APPROX. DATE	LOCAL NAME	TRANSLATED NAME
27 SEPTEMBER	EL SALEEB WINDS	CROSSWINDS
21 OCTOBER	EL SALEEBESH	CRUSADES
26 NOVEMBER	EL MICKNESS	BROOM GALE*
6 DECEMBER	KASSIM	GALE
20 DECEMBER	EL FEDRA/EL SAGHIRA	SMALL FEEDER GALE
11 JANUARY	EL FEDRA	GALE*
19 JANUARY	EL FEDRA/EL KABIRA	LARGE FEEDER GALE
28 JANUARY	EL FEDRA	GALE
18 FEBRUARY	EL SHAMS/EL SAGHIRA	SUN GALE*
10 MARCH	EL HOSSUM	EQUINOX GALE
20 MARCH	EL SHAMS/EL KABIRA	BIG SUN GALE*
25 MARCH	HANA	WIND GALE
29 APRIL	KHAMSEEM WINDS	SAND LADEN S/SW WIND

Each episode generally lasts 3 days.
* - These winds are typically stronger than others.

NOTE: For more detailed information on hazardous weather conditions, see previous Table 2-1 in this section and Hazardous Weather Summary in Section 3.

REFERENCES

FICEURLANT, 1984 (Reissued 1987): Port Directory for Larnaca, Cyprus. Fleet Intelligence Center Europe and Atlantic, Norfolk, VA.

PORT VISIT INFORMATION

May 1990: NOARL Meteorologists R. Fett and R. Miller met with Port Officer and Pilot, Capt. D. Petrov to obtain much of the information included in this port evaluation.

3. GENERAL INFORMATION

This section is intended for Fleet meteorologists/oceanographers and staff planners. Paragraph 3.5 provides a general discussion of hazards and Table 3-1 provides a summary of vessel locations/situations, potential hazards, effect-precautionary/evasive actions, and advance indicators and other information by season.

3.1 Geographic Location

The Port of Larnaca is located on the southeast coast of the island of Cyprus in the eastern Mediterranean Sea at approximately 35°56'N 33°39'E (Figure 3-1).

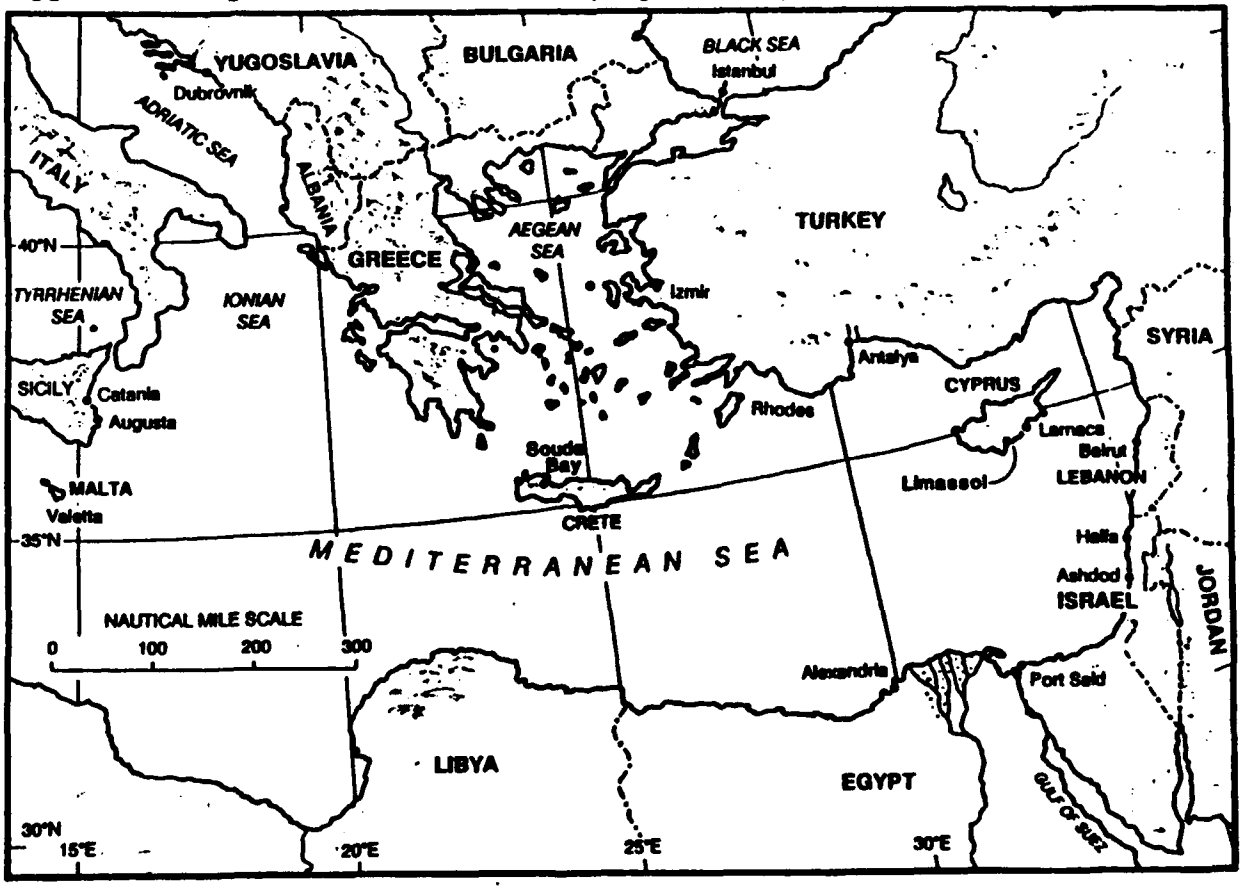


Figure 3-1. Eastern Mediterranean Sea.

Larnaca is situated about 12 n mi west of Cape Greco and 7 n mi north-northeast of Cape Kiti (Figure 3-2). Cyprus is largely mountainous, with the Troodos Mountains in the west central portion of the island having the highest elevation, Mount Olympus, which reaches 6,404 ft (1,952 m) about 38 n mi west of the port. The Kyrenia Range extends east-west along the north coast of the island, with elevations over 2,953 ft (900 m) occurring in several areas. The highest elevation near Larnaca is a peak of 2,011 ft (613 m) situated some 14 n mi west. Low lying salt pans exist near the coast south-southwest of the port. (Figure 3-2)

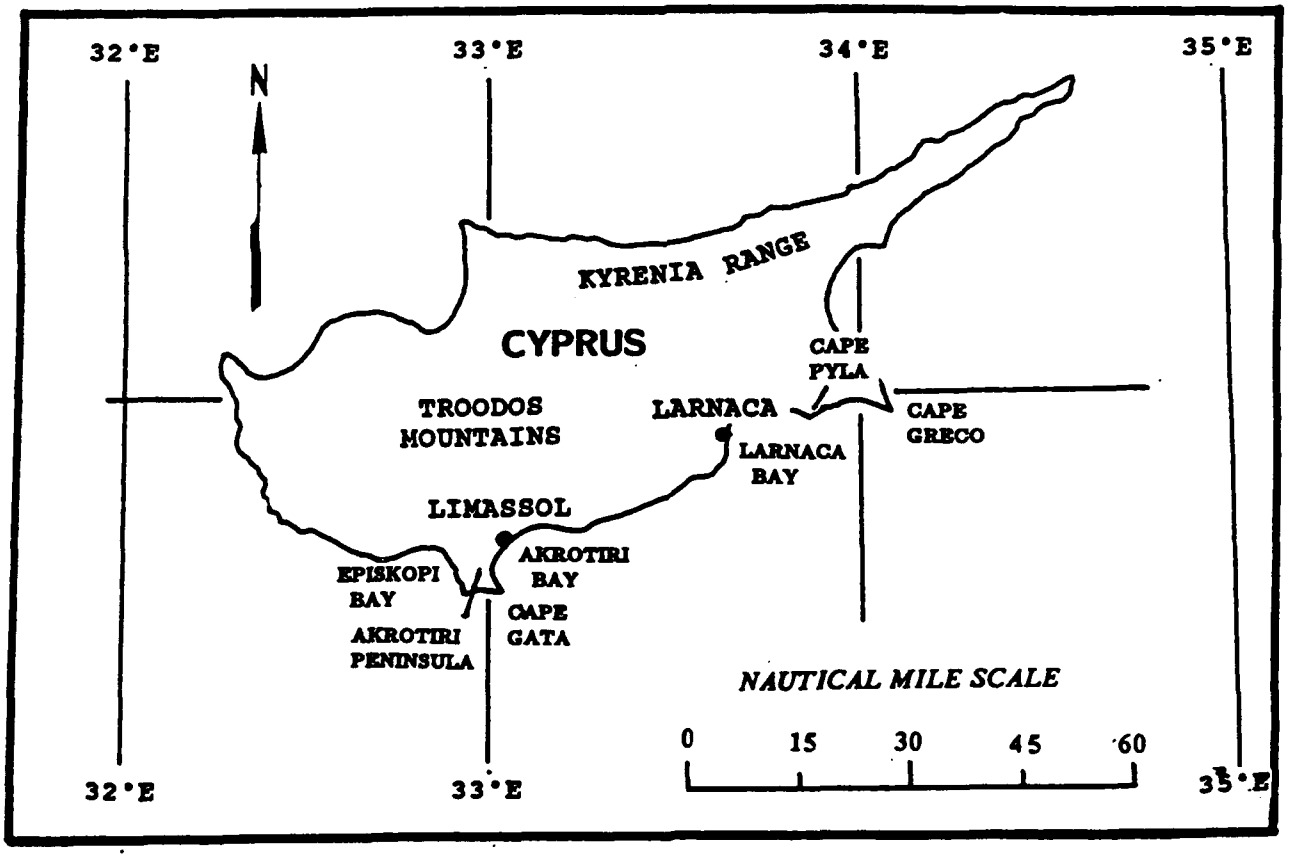


Figure 3-2. Cyprus.

The Port of Larnaca is located on Larnaca Bay (Figure 3-3). The port is composed of two sections: an older, smaller harbor with limited facilities, and a newer, larger harbor which can accommodate larger vessels. It is the newer harbor which is of interest to this study. It is located north of the smaller facility, and is entered between two breakwaters. The channel of the approach to the new harbor is dredged to a depth of 31 ft (9.4 m) and has a maximum width of 350 ft (106.7 m) at the entrance (FICEURLANT, 1984). (Figure 3-3)

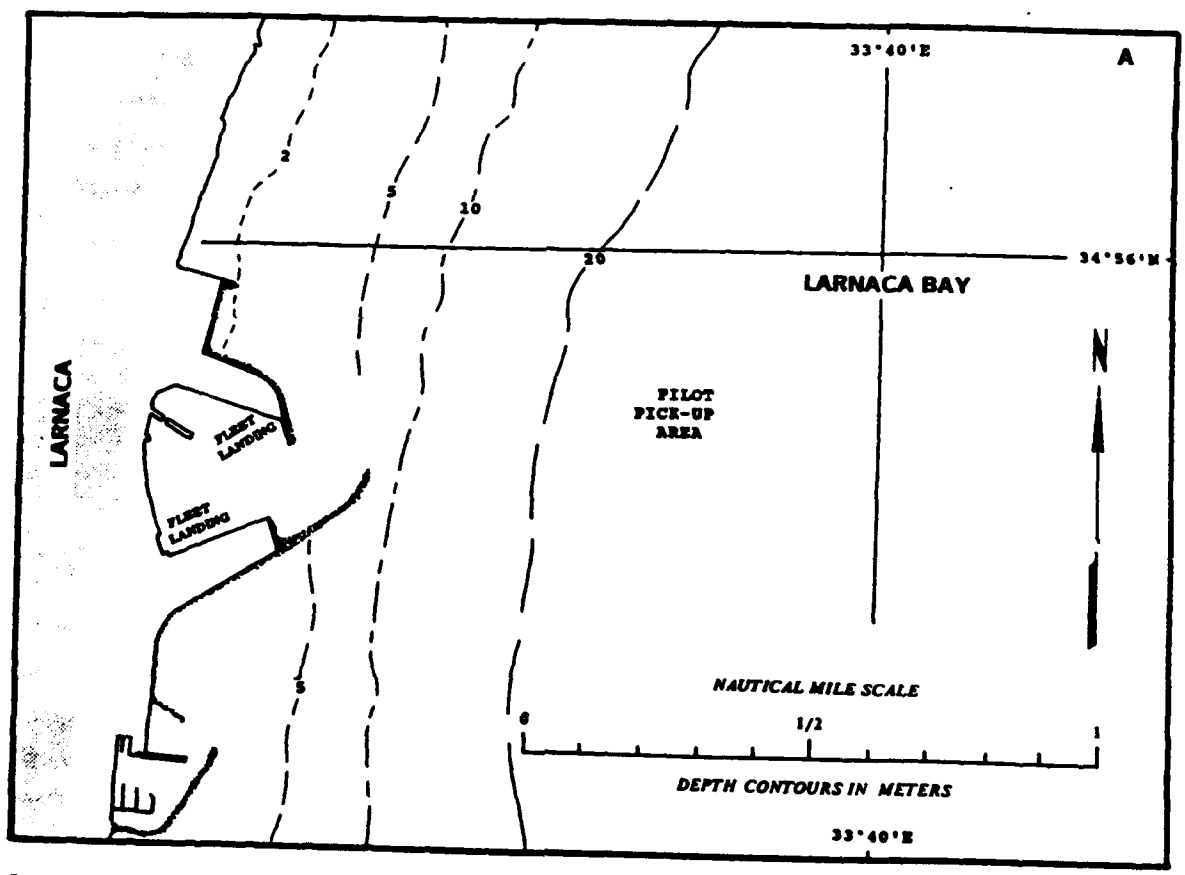


Figure 3-3. Port of Larnaca.

The largest berth in the harbor can accommodate vessels to 660 ft (201 m) in length which draw no more than 31 ft (9.4 m) of water. Smaller ships (less than 328 ft (100 m) long) can berth at the central pier. Fleet landings have been established at two locations in the harbor and are indicated on Figure 3-3. The northeast landing has a 5.25 ft (1.6 m) ramp height, while the southwest landing has a ramp height of 3 ft (0.9 m).

Local port authorities said an anchorage for aircraft carriers is located 1.5 n mi northeast (060° true) from the north end of the east breakwater of the new harbor (indicated by the letter A on Figure 3-3). Good holding on a sand and weed bottom is provided. FICEURLANT (1984) specifies that "Tankers awaiting a berth should anchor north of 34-56N. Cargo and passenger vessels should anchor south of a line drawn 90 degrees due east from the head of the south breakwater of the main harbor. Anchoring is prohibited in the area between these two lines to a distance of 2.8 kilometers (1.75 miles) from the coast."

3.2 Qualitative Evaluation of the Port of Larnaca

With the exception of the anchorages, which are located outside the protection of the breakwaters, the port provides excellent protection from hazardous wave conditions. Northeast through southeast winds bring swell into the harbor, but have never closed the port. The maximum swell in the harbor is limited to just over 3 ft (1 m). There is little reflection of wave action due to absorption by rocks in the breakwaters.

The anchorages are exposed to wave action. The maximum swell experienced at the anchorage indicated by the letter A on Figure 3-3 is 10-14 ft (3-4 m) and normally lasts 2 to 3 days. Anchor dragging by vessels with large sail areas is possible in winds of 22 kt or greater. FICEURLANT (1984) states that "anchorage off Larnaca is safe throughout the year for vessels having good ground tackle, but the short sea and heavy swell generated by southeast gales makes it uncomfortable at times.

South and southeast gales usually shift to the southwest, and if vessels drag, they usually do so parallel to the shore."

Due to the topography of the island, the port is well protected from northerly winds. Small boat operations can continue in winds up to 22 kt (force 6), while pilot boats operate in winds up to 34 kt (force 8). Small boat operations are canceled on an average of 2 to 3 days per month during afternoons in winter.

3.3 Currents and Tides

According to local authorities, tides are limited to 1 ft (30 cm). Currents vary according to prevailing winds. A wind of 22-33 kt (force 6-7) can generate a 0.5 to 0.8 kt current.

3.4 Visibility

Visibility restriction is generally not a problem at the Port of Larnaca and causes no significant problems with operations except for occasional morning fog experienced in spring and fall. On these occasions visibility is reduced to near zero, but clears by 0800-0900L. Suspended dust occurs in July and August and can reduce visibility to 3 n mi.

3.5 Hazardous Conditions

Although their effect is not severe, winds and waves from northeast through south pose the greatest hazards to the Port of Larnaca. Winds from the northeast to southeast bring swell into the harbor, but the swell height is limited to about 3 ft (1 m).

Maximum swell in the anchorages is 10-14 ft (3-4 m), and usually lasts 2 to 3 days. Local authorities state that ships have never had to move from the anchorage, although Cape Pyla, approximately 10 n mi east of the port, can provide better shelter from easterly sea and swell. If the wind is from the southeast, better conditions can be found near shore west of Cape Kiti, about 7 n mi south of the port. See Figure 3-2. South and southeast gales usually shift to southwest. If anchored vessels drag anchor, they usually do so under the southwest flow which moves them parallel to the shore (FICEURLANT, 1984).

Small boat operations can normally continue up to 22-27 kt (force 6), but a 11-16 kt (force 4) sea breeze can create a chop on warm days. Direction is usually southeast, but may vary from southeast to southwest. Onset is during late morning, and it lasts until about 1800L. A northerly land breeze is common at night.

Precipitation occurs on an average of 64 days per year at Limassol, which is located approximately 34 n mi west-southwest of Larnaca. Data for Larnaca would likely approximate that of Limassol. Figure 3-4 shows the annual distribution of precipitation by average days of occurrence per month.

Thunderstorms are relatively rare, occurring once every 3-5 years. Hail up to 3/4 in (2 cm) in diameter is possible.

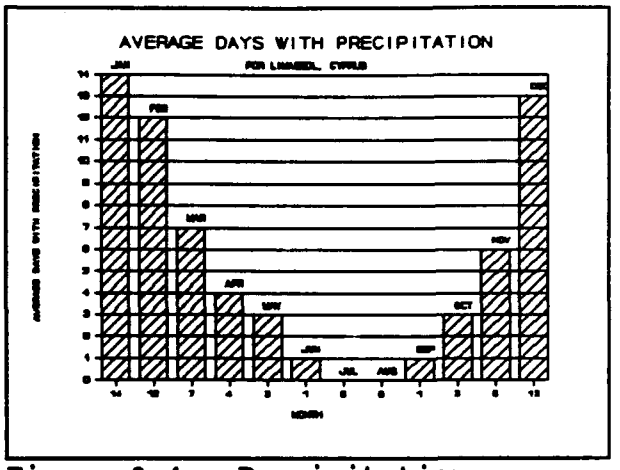


Figure 3-4. Precipitation.

A seasonal summary of various known environmental hazards that may be encountered in the Port of Larnaca follows.

A. Winter (November through February)

During the winter season the Eurasian land mass north of the eastern Mediterranean Sea is very cold in comparison to the sea surface temperature near Cyprus. Upper level westerlies are often found over the Mediterranean during this period, resulting in cyclonic activity, unsettled weather and strong winds (Brody and Nestor, 1980).

Local authorities state the most common hazardous weather condition during the winter season is caused by high pressure over Turkey and low pressure to the south near Egypt. The resultant pressure gradient brings northeast to southeast winds to the Larnaca area. Limassol, located about 34 n mi west-southwest of Larnaca, receives rain on 6 days during November, 13 in December, 14 in January, and 12 in February (see Figure 3-4). Larnaca's precipitation frequency would likely approximate that of Limassol.

Brody and Nestor (1980) describe several regional weather phenomena which affect the eastern Mediterranean in

general, and consequently have the potential to affect the weather at Larnaca during the winter season.

1. Bora. The Bora is a fall wind whose source is so cold that when the air reaches the coast of the Mediterranean Sea, the dynamic warming is insufficient to raise the air temperature to the normal for the region. Although more common along the coast of Yugoslavia, the Bora can occur in the Aegean Sea, mainly during the winter. When it does, it occasionally extends into the eastern Mediterranean near Cyprus. Such an occurrence is associated with cold outbreaks, and depends on the depth of the cold air. If the cold air is shallow (5,000 ft or less) over the Aegean Sea, Bora conditions rarely extend south of Crete. If the cold air is deeper than 5,000 ft, however, the Bora will cross Crete and move into the eastern Mediterranean. The direction of the Bora generally is northerly near Crete, becoming west-northwesterly in the eastern Mediterranean.

Weather associated with the Bora in the eastern Mediterranean depends on the length of overwater trajectory of the cold, initially dry air. Convective cloudiness and some showers can be expected since the cold air has a long overwater track and picks up moisture from the relatively warm water surface.

2. Scirocco. Scirocco is a name given to southeasterly to southwesterly winds over the Mediterranean Sea which originate over North Africa. The air's source regions are desert, consequently the Scirocco is extremely dry at its source, warm in winter, and hot in spring and summer. In the eastern Mediterranean, the Scirocco originates over the deserts of Libya and Egypt as well as over the Arabian desert. When the source of the Scirocco is the Arabian desert, the direction of the winds is often southeasterly.

Weather associated with the Scirocco is highly variable depending on the modifications that have occurred over the relatively cool water. By the time the Scirocco reaches the

northern portion of the eastern Mediterranean, the air has cooled and collected moisture in its lower layers; thus low stratus, fog and drizzle with reduced visibility are common. Because of a strong surface inversion produced over the water, extremely anomalous radar and radio propagation are likely.

Heavy rain is likely near frontal boundaries and along topographical barriers. Such barriers would likely include the mountains of Cyprus.

3. Cyprus Depressions. The Cyprus depression develops in the lee of the Taurus Mountains of Turkey in the general region from the Gulf of Antalya to Cyprus (Figure 3-1). These cyclones are usually most intense during the period of November through April.

Weather conditions to the west of a Cyprus Depression are typical for the classic case of cold air moving over relatively warm water, i.e., strong-to-gale-force, squally winds with heavy showers. The weather at Larnaca would likely be similar to the unstable conditions experienced with a Bora that extends into the eastern Mediterranean. See section 3.5.A.1 above. Scirocco conditions may occur ahead of the developing low if desert air from the south or southeast is drawn into the circulation.

B. Spring (March through May)

Weather during March and the first part of April is similar to that of winter, but spring is noted for periods of unsettled winter-type weather associated with increased occurrences of North African cyclones; otherwise spring weather is much like summer's (Brody & Nestor, 1980).

Limassol, located about 34 n mi west-southwest of Larnaca, experiences precipitation on an average of 7 days during March, 4 days during April, and 3 days during May (see Figure 3-4). Larnaca's precipitation frequency would likely approximate that of Limassol.

The Port of Larnaca experiences fog during the spring season. On occasion, fog may reduce the visibility to near zero, but it usually clears by 0800-0900L.

Brody and Nestor (1980) describes several regional weather phenomena which affect the eastern Mediterranean in general, and consequently have the potential to affect the weather at Larnaca during the spring season.

1. Bora. The Bora is described in section 3.5.A.1 above. Because it is dependent on extremely cold air over the landmass north of the Mediterranean Sea, the threat diminishes rapidly with the progression of the spring season.

2. Scirocco. The Scirocco is described in section 3.5.A.2 above. At some distance from the African coast, which includes the island of Cyprus, the Scirocco occurs most frequently during the cool season, November through April. Consequently, Scirocco occurrences are usually limited to the first month or two of the spring season. During Sciroccos, extremely anomalous radar and radio propagation are likely, especially during spring.

3. Cyprus Depressions. The Cyprus depression develops in the lee of the Taurus Mountains of Turkey in the general region from the Gulf of Antalya to Cyprus (Figure 3-1), and are discussed in section 3.5.A.3 above. These cyclones usually become most intense from November through April, so they are most likely to affect the weather at Larnaca during the first part of the spring season.

4. North African Cyclones. The North African cyclones develop over the desert region south of the Atlas Mountains,and are more likely to occur during spring than any other month. These systems usually move northeastward upon reaching the Tunisia/Gulf of Gabes region, but may continue moving eastward just south of the North African coast. Since various tracks are possible, it can be very difficult to forecast when and if a North African cyclone will affect the eastern Mediterranean.

Of special concern to the forecaster in the eastern Mediterranean are the desert depressions that move eastward just south of the North African coast during spring. These systems are hard to track because of the scarcity of timely surface data over North Africa. If the depressions deepen, they are likely to move northeastward. If a North African cyclone moves out over the water, the Scirocco becomes the primary weather phenomenon associated with it. Anomalous radar and radio propagation are likely because of strong low level inversions.

C. Summer (June through September)

The monsoonal effect leads to the development of an intense heat trough over southern Asia that extends westward over Turkey. With higher pressure over the relatively cooler sea surface of the Mediterranean, settled and dry weather with westerly winds persist during the summer (Brody & Nestor, 1980).

Precipitation statistics indicate that rainfall is infrequent during the summer. Records for Limassol, about 34 n mi west-southwest of Larnaca, show that precipitation occurs on an average of 1 day in June, 0 days in July and August, and only 1 day during September (see Figure 3-4).

Even though most of the more hazardous weather conditions are prominent during the other seasons, some may occur during the summer months. Brody and Nestor (1980) describe several regional weather phenomena which affect the eastern Mediterranean in general, and consequently have the potential to affect the weather at Larnaca during the summer season.

1. Etesian. The Etesian is a northerly to westerly wind that occurs during the summer over the Aegean and eastern Mediterranean seas. In the eastern Mediterranean area, the Etesian occurs as a southeastward extension of the wind regime from the Aegean Sea. The maximum winds axis passes southeastward through the opening between Rhodes and Crete, and then eastward with reduced strength to the south of Cyprus. The direction of the Etesian in the eastern Mediterranean follows the

axis of maximum winds: northwesterlies east of Crete become westerlies south of Cyprus. Gale force Etesians are most likely in the sea area east of Crete, and occur with decreasing frequency southeastward.

Etesian weather over the eastern Mediterranean is generally dry with good visibility. Because of the long overwater trajectory of the air, cumulus clouds are likely.

2. Scirocco. Scirocco conditions are discussed in section 3.5.A.2 above. Although it is possible to experience a Scirocco during the summer, a significant event would be unusual.

3. Cyprus Depressions. The Cyprus depression develops in the lee of the Taurus Mountains of Turkey in the general region from the Gulf of Antalya to Cyprus (Figure 3-1). These cyclones are most intense from November through April, so although summer occurrences are possible, they do not usually pose any significant threat to the Port of Larnaca.

D. Autumn (October)

The autumn season in the Mediterranean area is short, usually lasting only for the month of October. It is characterized by an abrupt change from the relatively subdued summer weather to the unsettled weather of winter. By the end of the month, the extratropical storm track has moved southward from its summertime location over Europe, and extratropical storms again transit the Mediterranean region. The threat of strong northeast, clockwise, to southeast winds increases as the month progresses. Hazardous weather conditions which may be expected by the end of the month are described in section 3.5.A above.

Precipitation frequency starts to increase by the end of the month. Records for Limassol, located about 34 n mi westsouthwest of Larnaca indicate that rain can be expected on an average of 3 days during the month of October (see Figure 3-4).

The Port of Larnaca experiences fog during the autumn season. Fog may occasionally reduce the visibility to near zero, but it usually clears by 0800-0900L.

3.6 Harbor Protection

As detailed below, the Port of Larnaca is a relatively safe port under most weather scenarios.

3.6.1 Wind and Weather

The Troodos mountains west of Larnaca provide a barrier to westerly winds so that winds from that direction are essentially non-existent at the port. The harbor is also well protected from northerly winds due to the Kyrenia mountain range which extends east-west along the north coast of the island. Winds from northwest and northeast must cross the island of Cyprus to reach the port, so their speed would be reduced due to terrain effects.

The port offers little protection from winds from northeast clockwise through west-southwest. However, winds have never closed the port, even when reaching 34-47 kt (force 8-9).

The anchorages are fully exposed to the wind. Anchor dragging is a concern when the winds reach 22 kt or stronger. According to FICEURLANT (1984), south and southeast gales usually shift to the southwest, so if vessels drag anchor, they usually do so parallel to the shore.

Small boat operations continue up to about 22 kt (force 6). Pilot boat operations continue up to gale force (34 kt).

Thunderstorms and/or hail are relatively rare at the port, occurring only once each 3 to 5 years. Hail may reach 3/4 in (2 cm) in diameter.

3.6.2 Waves

The harbor is well protected from wave and swell action. The entrance is open to the north-northeast, and the fetch in that direction is limited to only about 5 n mi. Swell waves refracting into the harbor do not pose a problem since their maximum height in the harbor is limited to only about 3 ft (1 m).

Waves at the anchorage may reach 10-14 ft (3-4 m), and last 2-3 days. Ships have never had to move from the anchorage, although Cape Pyla, about 10 n mi east of the port would provide better shelter from easterly winds and swell.

3.7 Protective and Mitigating Measures

3.7.1 Moving to a New Anchorage

Although ships have never had to move from the anchorage due to winds and/or seas, when they are expected to increase from the east, Cape Pyla, approximately 10 n mi east of the port, would provide better shelter from both. If winds and/or seas are expected to increase from the southeast, better conditions can be found near shore west of Cape Kiti, about 7 n mi south of the port.

3.7.2 Scheduling

The strongest winds at Larnaca are from the northeast through southeast. The winds have a diurnal variability in intensity, generally sustaining 7-16 kt (force 3-4) during the night, increasing to 17-27 kt (force 5-6) about 0800L, and diminishing to nighttime levels during the evening.

3.8 Local Indicators of Hazardous Weather Conditions

No local indicators were revealed during the visit to the port. It was suggested that the Larnaca Meteorological Office at the airport should be relied on for weather guidance. However, the Phonecian Wind Prediction Calendar, included at the end of this section, may be of use in anticipating wind events.

Meteorologists should be alert to watch for building high pressure over Turkey with lower pressure over Egypt in order to anticipate the onset of northeast to southeast winds and waves, the worst weather conditions at Larnaca. In addition to the foregoing, the following rules, which have been taken from Brody and Nestor (1980), give some insight to the development of hazardous weather conditions at Larnaca.

Etesian winds - During a gale force Etesian over the Aegean Sea, the axis of maximum winds passes south-eastward through the opening between Rhodes and Crete into the eastern Mediterranean Sea. The strength of the Etesian diminishes downwind, and south of Cyprus its direction becomes westerly.

Scirocco - A good indication of the start of a Scirocco in the eastern Mediterranean is the development of strong southerly winds at stations along the northeast coast of Libya.

Haze - Salt haze is a serious problem for flight operations over the Mediterranean. This haze has the following characteristics:

1. It is most prevalent during the summer and early autumn.

2. Its color is bluish white, as opposed to the brown of dust haze.

3. Salt haze scatters and reflects light rays much more than does dust haze.

4. Salt haze sometimes extends to over 12,000 ft and has been reported up to 20,000 ft.

5. Although surface visibility in salt haze may be as high as 4-6 n mi, the slant visibility for a pilot making a

landing approach may be near zero, especially if the approach is in the general direction of the sun.

6. Salt haze is sometimes thicker aloft than at the surface.

7. Salt haze is less of a problem after sunset since the poor visibility is caused partially by scattering and reflection.

Salt haze is most likely to develop in a stagnant air mass when there is a lack of mixing. It is especially prevalent when there is a strong ridge present at the surface and aloft. It will not completely disperse until there is a change of air masses such as occurs with a frontal passage. Visibility will improve if there is an increase in the wind speeds at the 850 and/or 700 mb levels.

Miscellaneous

1. Gale force northwesterlies occur in the eastern Mediterranean as an extension of the Bora in the Aegean Sea if the cold air is deep (greater than 5,000 ft). Shallow cold air will not extend south of Crete and therefore will not affect the eastern Mediterranean.

2. If summer winds are calm near Cyprus and stronger winds are sought for carrier operations:

a. A day breeze can be found close inshore off Akrotiri (40 n mi west-southwest of Larnaca) even when winds are calm 15 n mi offshore.

b. A night wind can be found about 40 n mi southwest of Cape Gata (37 n mi west-southwest of Larnaca).

3. Cyprus depressions usually form in the late autumn or early spring when a deep stream of cold air moves toward the eastern Mediterranean from the Balkans or the Black Sea.

4. Cyclogenesis can be expected to begin in the Cyprus area when a cold front approaches the Anatolian plateau (in central Turkey) from the north.

5. Strong surface ridging eastward across Morocco is an indication that a North African cyclone will move/develop over

Tunisia, east of the Atlas Mountains. If surface winds at Algiers shift from southwesterly to northwesterly in association with the ridging, cyclogenesis will occur east of the Atlas Mountains.

6. Cyclones developing on the southern edge of a cold surge over the Aegean Sea may move southward or even southwestward at first, but normally they later will move eastward to the Cyprus area.

7. The strongest winds associated with a deepening North African low, after the system moves out over the Mediterranean, occur in the northwest sector of the system rather than in the eastern sector.

8. Wind speeds at coastal stations in Israel and Cyprus are not good indicators of the wind strength at sea during periods of strong westerly flow in the eastern Mediterranean.

A port visit to the Port of Limassol, Cyprus produced a "Phonecian Wind Prediction Calendar" which is used locally to predict the onset of various wind events. The calendar is reported to be 90% successful. If wind does not occur, it is late, not absent. A copy of the calendar is included below.

PHONECIAN WIND PREDICTION CALENDAR

APPROX. DATE	LOCAL NAME	TRANSLATED NAME
27 SEPTEMBER	EL SALEEB WINDS	CROSSWINDS
21 OCTOBER	EL SALEEBESH	CRUSADES
26 NOVEMBER	EL MICKNESS	BROOM GALE*
6 DECEMBER	KASSIM	GALE
20 DECEMBER	EL FEDRA/EL SAGHIRA	SMALL FEEDER GALE
11 JANUARY	EL FEDRA	GALE*
19 JANUARY	EL FEDRA/EL KABIRA	LARGE FEEDER GALE
28 JANUARY	EL FEDRA	GALE
18 FEBRUARY	EL SHAMS/EL SAGHIRA	SUN GALE*
10 MARCH	EL HOSSUM	EQUINOX GALE
20 MARCH	EL SHAMS/EL KABIRA	BIG SUN GALE*
25 MARCH	HANA	WIND GALE
29 APRIL	KHAMSEEM WINDS	SAND LADEN S/SW WINDS

Each episode generally lasts 3 days.

* - These winds are typically stronger than others.

3.9 Summary of Problems, Actions, and Indicators

Table 3-1 is intended to provide easy-to-use seasonal references for meteorologists on ships using the Port of Larnaca. Table 2-1 (Section 2) summarizes Table 3-1 and is intended primarily for use by ship captains.

Table 3-1. Potential problem situation

VESSEL LOCATION/ SITUATION AFFECTED	POTENTIAL HAZARD	EFFECT - PRECAUTIONAR
1. Moored -Inner Harbor. Strongest in Winter & early Spring Uncommon in Summer & early Autumn	a. NE-SE'ly winds/waves - Creates the worst weather conditions at the port. Wind speeds are 7-16 kt until about 0800L, then increase to 17-27 kt and remain so until diminishing during evening. Waves reach the outer harbor, but do not impact the inner harbor significantly. Inner harbor swell heights are limited to about 3 ft (1 m). Wave reflection is limited by absorption on rocks near harbor entrance.	a. Worst conditions for po inner harbor is well protec force. Vessels should stay Larnaca Meteorological Offi see if strong winds are exp mooring lines as required. winds in the port should no
Strongest in Winter & early Spring Uncommon in Summer & early Autumn	b. Scirocco winds - Warm SE to SW wind originating in deserts of N Africa. Associated weather may include low stratus, fog and drizzle with reduced visibility. Heavy rain is likely near frontal boundaries and topographical barriers such as the mountains of Cyprus.	b. Minimal impact on the ha protected except against wir should stay in contact with logical Office at the airpor winds are expected and doubl required. Extremely anomalc propagation may be experienc level inversion.
Strongest in Winter & early Spring Uncommon in Summer & early Autumn	c. Cyprus depressions - Generally form between Turkey and Cyprus. Most intense November through April. Associated weather includes strong-to-gale force, squally winds with heavy showers.	c. The potential for stron heavy showers exists in the conditions should not adver sels.

l problem situations at the Port of Larnaca, Cyprus - ALL SEASONS

- PRECAUTIONARY/EVASIVE ACTIONS	ADVANCE INDICATORS AND OTHER INFORMATION ABOUT POTENTIAL HAZARD
conditions for port in general, but the or is well protected except against wind ssels should stay in contact with the teorological Office at the airport to ong winds are expected and double/add nes as required. A sortie to avoid high he port should not be necessary.	a. The winds are caused by high pressure over Turkey and coincident low pressure to the S near Egypt, which results in a strengthened pressure gradient over the Larnaca area. Prognostic charts should be reviewed with this scenario in mind.
l impact on the harbor since it is well except against wind force. Vessels in contact with the Larnaca Meteoro- ice at the airport to see if strong expected and double/add mooring lines as Extremely anomalous radar and radio n may be experienced due to a strong low sion.	b. In the E Mediterranean, the Scirocco originates to the S over the deserts of Libya and Egypt, and over the Arabian desert to the SE. When the source is the Arabian desert, the direction of the Scirocco is often SE'ly. At some distance from the N African coast, Scirocco events occur most frequently during the November-April period and are usually found E of cyclones that develop either over the S Aegean Sea/Sea of Crete or near Cyprus. See Cyprus Depressions in section 1.c below. A good indication of the start of a Scirocco in the E Mediterranean is the development of strong S'ly winds at stations along the NE coast of Libya.
tential for strong, gusty winds and ers exists in the harbor, but overall should not adversely affect moored ves-	c. Cyprus depressions develop in the lee of the Taurus Mountains of Turkey in the general region from the Gulf of Antalya to Cyprus (Figure 3-2). They can develop during any season, but usually become most intense from November through April. Factors associated with the development of an intense Cyprus depression include: (1) The thermal contrast between land and water. (2) Interaction between the polar front jet stream and the subtropical jet stream. (3) Effect of N'ly flow over the mountains of Turkey enhancing cyclogenetic activity along the southern slopes. (4) Topographic features blocking cold fronts' S movement. Cyclones also form over the S Aegean Sea and Sea of Crete. If one forms along the leading edge of a significant cold surge, it may move S or even SW at first, but later it will take a more E'ly track to the Cyprus area.

Table 3-1. (Continued)

VESSEL LOCATION/ SITUATION AFFECTED	POTENTIAL HAZARD	EFFECT - PRECAUTIONARY/
Possible in Winter Most common in Spring Uncommon in Summer Possible in Autumn	d. N African cyclones - Low pressure systems which develop over N Africa. Primary weather concern is development of Scirocco conditions (i.e. low stratus, fog and drizzle with reduced visibility) in S'ly flow on E side of system.	d. The majcr impact on harbor ited to effects similar to thc outlined in 1.b above. Anomal propagation may be experienced
2. Anchored. Strongest in Winter & early Spring Uncommon in Summer & early Autumn	a. NE-SE'ly winds/waves - Creates the worst weather conditions at the port. Wind speeds are 7-16 kt until about 0800L, then increase to 17-27 kt and remain so until diminishing during evening. Waves at the anchorage may reach 10-14 ft (3-4 m) and last for 2-3 days.	a. Worst conditions for the a have never had to move from th although Cape Pyla, approximat port, would provide better she and swell. If the wind is SE, can be found near shore W of C mi S of the port. Winds of 22 may cause anchor dragging, for sail areas. FICEURLANT (1984) age off Larnaca is safe throug vessels having good ground tac sea and heavy swell generated uncomfortable at times. S and shift to SW, and if vessels dr usually do so parallel to the
Strongest in Winter & early Spring Uncommon in Summer & early Autumn	b. Scirocco winds - Warm SE to SW wind originating in deserts of N Africa. Associated weather may include low stratus, fog and drizzle with reduced visibility. Heavy rain is likely near frontal boundaries and topographical barriers such as the mountains of Cyprus.	b. Minimal effect. A steady raise waves to 8 ft in the anc pose no problem for anchored s anomalous radar and radio prop rienced.

Table 3-1. (Continued)

CT - PRECAUTIONARY/EVASIVE ACTIONS	ADVANCE INDICATORS AND OTHER INFORMATION ABOUT POTENTIAL HAZARD
major impact on harbor operations is lim- effects similar to those of a Scirocco as d in 1.b above. Anomalous radar and radio tion may be experienced.	d. N African cyclones develop over the desert region S of the Atlas Mountains. They usually move NE upon reaching the Tunisia/Gulf of Gabes region, but may continue moving E just S of the N African coast. Since various tracks are possible, it can be very difficult to forecast when and if a N African cyclone will affect the E Mediterranean. Of special concern to the forecaster in the E Mediterranean are the desert depressions that move E just S of the N African coast during spring. The systems are hard to track because of the scarcity of timely surface data over N Africa. If the depressions deepen, they are likely to move NE.
t conditions for the anchorages. Ships er had to move from the anchorage, Cape Pyla, approximately 10 n mi E of the uld provide better shelter from E'ly winds 1. If the wind is SE, better conditions ound near shore W of Cape Kiti, about 7 n the port. Winds of 22-33 kt (force 6-7) e anchor dragging, for vessels with large as. FICEURLANT (1984) states that anchor- Larnaca is safe throughout the year for having good ground tackle, but the short heavy swell generated by SE gales makes it table at times. S and SE gales usually SW, and if vessels drag anchor, they do so parallel to the shore.	a. The winds are caused by high pressure over Turkey and coincident low pressure to the S near Egypt, which results in a strengthened pressure gradient over the Larnaca area. Prognostic charts should be reviewed with this scenario in mind.
mal effect. A steady wind of 20 kt could ves to 8 ft in the anchorage but should problem for anchored ships. Extremely s radar and radio propagation may be expe-	b. In the E Mediterranean, the Scirocco originates to the S over the deserts of Libya and Egypt, and over the Arabian desert to the SE. When the source is the Arabian desert, the direction of the Scirocco is often SE'ly. At some distance from the N African coast, Scirocco events occur most frequently during the November-April period and are usually found E of cyclones that develop either over the S Aegean Sea/Sea of Crete or near Cyprus. See Cyprus Depressions in section 1.c below. A good indication of the start of a Scirocco in the E Mediterranean is the development of strong S'ly winds at stations along the NE coast of Libya.

VESSEL LOCATION/ SITUATION AFFECTED	POTENTIAL HAZARD	EFFECT - PRECAUTION
Strongest in Winter & early Spring Uncommon in Summer & early Autumn	c. Cyprus depressions - Generally form between Turkey and Cyprus. Most intense November through April. Associated weather includes strong-to-gale force, squally winds with heavy showers.	c. Ships should be aware strong, gusty winds and h direction is S or SW, and Otherwise, few problems s
Possible in Winter Most common in Spring Uncommon in Summer Possible in Autumn	d. N African cyclones - Low pressure systems which develop over N Africa. Primary weather concern is development of Sirocco conditions (i.e. low stratus, fog and drizzle with reduced visibility) in S'ly flow on E side of system.	d. Minimal effect unless than normal winds to the could occur in a strong e 20 kt could raise waves t but should pose no proble Anomalous radar and radio rienced.
3. Arriving/ Departing Strongest in Winter & early Spring Uncommon in Summer & early Autumn	a. NE-SE'ly winds/waves - Creates the worst weather conditions at the port. Caused by high pressure over Turkey and low pressure over/near Egypt. Wind speeds are 7-16 kt until about 0800L, then increase to 17-27 kt and remain so until diminishing during evening. Waves reach the outer harbor, but do not impact the inner harbor significantly. Inner harbor swell heights are limited to about 3 ft (1 m). Wave reflection is limited by absorption on rocks near harbor entrance. Waves at the anchorage may reach 10-14 ft (3-4 m) and last for 2-3 days.	a. Arriving vessels shou situation poses no signif for the inner harbor, but tions for the anchorages. move from the anchorage, proximately 10 n mi E of better shelter from E'ly wind is SE, better condit shore W of Cape Kiti, abo Pilot boats from the port increase to gale force (3 22-33 kt (force 6-7) may for vessels with large sa (1984) states that anchor throughout the year for v tackle, but the short sea ed by SE gales makes it u and SE gales usually shif drag anchor, they usually shore.

Table 3-1. (Continued)

- PRECAUTIONARY/EVASIVE ACTIONS	ADVANCE INDICATORS AND OTHER INFORMATION ABOUT POTENTIAL HAZARD
should be aware of possibility of usty winds and heavy showers. If wind is S or SW, anchor dragging may occur. few problems should be experienced.	c. Cyprus depressions develop in the lee of the Taurus Mountains of Turkey in the general region from the Gulf of Antalya to Cyprus (Figure 3-2). They can develop during any season, but usually become most intense from November through April. Factors associated with the development of an intense Cyprus depression include: (1) The thermal contrast between land and water. (2) Interaction between the polar front jet stream and the subtropical jet stream. (3) Effect of N'ly flow over the mountains of Turkey enhancing cyclogenetic activity along the southern slopes. (4) Topographic features blocking cold fronts' S movement. Cyclones also form over the S Aegean Sea and Seaof Crete. If one forms along the leading edge of a significant cold surge, it may move S or even SW at first, but later it will take a more typical E'ly track to the Cyprus area.
al effect unless event brings stronger al winds to the port. Anchor dragging ur in a strong event. Sustained winds of ld raise waves to 8 ft in the anchorage d pose no problem for anchored ships. radar and radio propagation may be expe-	d. N African cyclones develop over the desert region S of the Atlas Mountains. They usually move NE upon reaching the Tunisia/Gulf of Gabes region, but may continue moving E just S of the N African coast. Since various tracks are possible, it can be very difficult to forecast when and if a N African cyclone will affect the E Mediterranean. Of special concern to the forecaster in the E Mediterranean are the desert depressions that move E just S of the N African coast during spring. The systems are hard to track because of the scarcity of timely surface data over N Africa. If the depressions deepen, they are likely to move NE.
ng vessels should be aware that this poses no significant wave/swell problem ner harbor, but creates the worst condi- the anchorages. Ships have never had to the anchorage, although Cape Pyla, ap- y 10 n mi E of the port, would provide lter from E'ly winds and swell. If the , better conditions can be found near Cape Kiti, about 7 n mi S of the port. s from the port operate until winds o gale force (34 kt, force 8). Winds of force 6-7) may cause anchor dragging, s with large sail areas. FICEURLANT tes that anchorage off Larnaca is safe the year for vessels having good ground t the short sea and heavy swell generat- ales makes it uncomfortable at times. S es usually shift to SW, and if vessels r, they usually do so parallel to the	a. The winds are caused by high pressure over Turkey and coincident low pressure to the S near Egypt, which results in a strengthened pressure gradient over the Larnaca area. Prognostic charts should be reviewed with this scenario in mind.

VESSEL LOCATION/ SITUATION AFFECTED	POTENTIAL HAZARD	EFFECT - PRECAUTION
Strongest in Winter & early Spring Uncommon in Summer & early Autumn	b. Bora winds - A fall wind commonly occurring over the Ionian and Aegean Seas. A strong, deep event may extend SE from the Aegean Sea and reach the E Mediterranean. Direction is WNW in the E Mediterranean generally, and W near Cyprus.	b. Minimal effect at th conditions S of the port and waves created by the vessels should expect he of the protection of the ing vessels should be aw the port operate until w force (34 kt, force 8).
Strongest in Winter & early Spring Uncommon in Summer & early Autumn	c. Scirocco winds - Warm SE to SW wind originating in deserts of N Africa. Associated weather may include low stratus, fog and drizzle with reduced visibility. Heavy rain is likely near frontal boundaries and topographical barriers such as the mountains of Cyprus.	c. Minimal effect in th of 20 kt could raise wav age but should pose no p departing units. Extren radio propagation may be vessels should be aware port operate until winds (34 kt, force 8).
Strongest in Winter & early Spring Uncommon in Summer & early Autumn	d. Cyprus depressions - Generally form between Turkey and Cyprus. Most intense November through April. Associated weather includes strong-to-gale force, squally winds with heavy showers.	d. Ships should be awa strong, gusty winds and vessels should expect h of the protection of th ing vessels should be a the port operate until force (34 kt, force 8).

3-1. (Continued)

RECAUTIONARY/EVASIVE ACTIONS	ADVANCE INDICATORS AND OTHER INFORMATION ABOUT POTENTIAL HAZARD
ffect at the port, but open ocean of the port would be exposed to winds ated by the Bora winds. Departing d expect heavier weather when clear tion of the Cyprus land mass. Arriv- hould be aware that pilot boats from ate until winds increase to gale force 8).	b. The bora is a fall wind whose source is so cold that, when the air reaches the coast, the dynamic warming is insufficient to raise the air temperature to the normal level for the region. While most common along the Yugoslavian coast on the Ionian Sea, it also occurs over the Aegean Sea. It is this latter occasion when the winds sometime extend into the E Mediterranean Sea. One measure of the probable extent of such bora winds is the depth of the cold air. If the cold air is less then 5,000 ft deep, bora conditions rarely extend S of the island of Crete. Conversely, if the cold air depth exceeds 5,000 ft, the bora will most likely extend over the E Mediterranean Sea.
ffect in the harbor. A steady wind d raise waves to 8 ft in the anchor- d pose no problem for arriving or ts. Extremely anomalous radar and tion may be experienced. Arriving d be aware that pilot boats from the until winds increase to gale force 8).	c. In the E Mediterranean, the Scirocco originates to the S over the deserts of Libya and Egypt, and over the Arabian desert to the SE. When the source is the Arabian desert, the direction of the Scirocco is often SE'ly. At some distance from the N African coast, Scirocco events occur most frequently during the November-April period and are usually found E of cyclones that develop either over the S Aegean Sea/Sea of Crete or near Cyprus. See Cyprus Depressions in section 1.c below. A good indication of the start of a Scirocco in the E Mediterranean is the development of strong S'ly winds at stations along the NE coast of Libya.
ould be aware of possibility of winds and heavy showers. Departing d expect heavier weather when clear tion of the Cyprus land mass. Arriv- should be aware that pilot boats from rate until winds increase to gale force 8).	d. Cyprus depressions develop in the lee of the Taurus Mountains of Turkey in the general region from the Gulf of Antalya to Cyprus (Figure 3-2). They can develop during any season, but usually become most intense from November through April. Factors associated with the development of an intense Cyprus depression include: (1) The thermal contrast between land and water. (2) Interaction between the polar front jet stream and the subtropical jet stream. (3) Effect of N'ly flow over the mountains of Turkey enhancing cyclogenetic activity along the southern slopes. (4) Topographic features blocking cold fronts' S movement. Cyclones also form over the S Aegean Sea and Sea of Crete. If one forms along the leading edge of a significant cold surge, it may move S or even SW at first, but later it will take a more typical E'ly track to the Cyprus area.

VESSEL LOCATION/ SITUATION AFFECTED	POTENTIAL HAZARD	EFFECT - PRECAUTIONARY
Uncommon in Winter Most common in Summer, late Spring & early Autumn	e. Etesian winds - A N'ly to W'ly wind which occurs over the Aegean and E Mediterranean Seas. Because of the topography of Cyprus, Etesian winds do not reach the port with any significant velocity, but increased winds and waves may encountered S of Cape Kiti.	e. Minimal effect at the por conditions S of the port woul and waves created by the etes vessels should expect heavier of the protection of the Cypr ing vessels should be aware t the port operate until winds force (34 kt, force 8).
Possible in Winter Most common in Spring Uncommon in Summer Possible in Autumn	f. N African cyclones - Low pressure systems which develop over N Africa. Primary weather concern is development of Scirocco conditions (i.e. low stratus, fog and drizzle with reduced visibility) in S'ly flow on E side of system.	f. Minimal effect. A steady raise waves to 8 ft in the anc pose no problem for anchored s radar and radio propagation ma Arriving vessels should be awa from the port operate until wi force (34 kt, force 8).
4. Small boats. Strongest in Winter & early Spring Uncommon in Summer & early Autumn	a. NE-SE'ly winds/waves - Creates the worst weather conditions at the port. Wind speeds are 7-16 kt until about 0800L, then increase to 17-27 kt and remain so until diminishing during evening. Waves reach the outer harbor, but do not impact the inner harbor significantly. Inner harbor swell heights are limited to about 3 ft (1 m). Wave reflection is limited by absorption on rocks near harbor entrance. Waves at the anchorage may reach 10-14 ft (3-4 m) and last for 2-3 days.	a. Small boat operations nor wind force reaches 22 kt (for

Table 3-1. (Continued)

T - PRECAUTIONARY/EVASIVE ACTIONS	ADVANCE INDICATORS AND OTHER INFORMATION ABOUT POTENTIAL HAZARD
ıal effect at the port, but open ocean ıs S of the port would be exposed to winds ; created by the etesian event. Departing ;hould expect heavier weather when clear ;otection of the Cyprus land mass. Arriv- ;ls should be aware that pilot boats from operate until winds increase to gale ı kt, force 8).	e. In the E Mediterranean area, the etesian occurs as a SE extension of the wind regime from the Aegean Sea. The maximum wind axis passes SE through the opening between Rhodes and Crete, and then E with reduced strength S of Cyprus. The direction of the etesian in the E Mediterranean follows the axis of maximum winds: NW winds E of Crete become west S of Cyprus.
al effect. A steady wind of 20 kt could es to 8 ft in the anchorage but should roblem for anchored ships. Anomalous radio propagation may be experienced. vessels should be aware that pilot boats port operate until winds increase to gale kt, force 8).	f. N African cyclones develop over the desert region S of the Atlas Mountains. They usually move NE upon reaching the Tunisia/Gulf of Gabes region, but may continue moving E just S of the N African coast. Since various tracks are possible, it can be very difficult to forecast when and if a N African cyclone will affect the E Mediterranean. Of special concern to the forecaster in the E Mediterranean are the desert depressions that move E just S of the N African coast during spring. The systems are hard to track because of the scarcity of timely surface data over N Africa. If the depressions deepen, they are likely to move NE.
l boat operations normally continue until ;e reaches 22 kt (force 6).	a. The winds are caused by high pressure over Turkey and coincident low pressure to the S near Egypt, which results in a strengthened pressure gradient over the Larnaca area. Prognostic charts should be reviewed with this scenario in mind.

VESSEL LOCATION/ SITUATION AFFECTED	POTENTIAL HAZARD	EFFECT - PRECAUTIONAI
Strongest in Winter & early Spring Uncommon in Summer & early Autumn	b. Scirocco winds - Warm SE to SW wind originating in deserts of N Africa. Associated weather may include low stratus, fog and drizzle with reduced visibility. Heavy rain is likely near frontal boundaries and topographical barriers such as the mountains of Cyprus.	b. Small boat operations n wind force reaches 22 kt (f
Strongest in Winter & early Spring Uncommon in Summer & early Autumn	c. Cyprus depressions - Generally form between Turkey and Cyprus. Most intense November through April. Associated weather includes strong-to-gale force, squally winds with heavy showers.	c. Small boat operations r wind force reaches 22 kt (f
Possible in Winter Most common in Spring Uncommon in Summer Possible in Autumn	d. N African cyclones - Low pressure systems which develop over N Africa. Primary weather concern is development of Scirocco conditions (i.e. low stratus, fog and drizzle with reduced visibility) in S'ly flow on E side of system.	d. Small boat operations wind force reaches 22 kt (

Table 3-1. (Continued)

T - PRECAUTIONARY/EVASIVE ACTIONS	ADVANCE INDICATORS AND OTHER INFORMATION ABOUT POTENTIAL HAZARD
boat operations normally continue until e reaches 22 kt (force 6).	b. In the E Mediterranean, the Scirocco originates to the S over the deserts of Libya and Egypt, and over the Arabian desert to the SE. When the source is the Arabian desert, the direction of the Scirocco is often SE'ly. At some distance from the N African coast, Scirocco events occur most frequently during the November-April period and are usually found E of cyclones that develop either over the S Aegean Sea/Sea of Crete or near Cyprus. See Cyprus Depressions in section 1.d below. A good indication of the start of a Scirocco in the E Mediterranean is the development of strong S'ly winds at stations along the NE coast of Libya.
boat operations normally continue until e reaches 22 kt (force 6).	c. Cyprus depressions develop in the lee of the Taurus Mountains of Turkey in the general region from the Gulf of Antalya to Cyprus (Figure 3-2). They can develop during any season, but usually become most intense from November through April. Factors associated with the development of an intense Cyprus depression include: (1) The thermal contrast between land and water. (2) Interaction between the polar front jet stream and the subtropical jet stream. (3) Effect of N'ly flow over the mountains of Turkey enhancing cyclogenetic activity along the southern slopes. (4) Topographic features blocking cold fronts' S movement. Cyclones also form over the S Aegean Sea and Sea of Crete. If one forms along the leading edge of a significant cold surge, it may move S or even SW at first, but later it will take a more typical E'ly track to the Cyprus area.
boat operations normally continue until e reaches 22 kt (force 6).	d. N African cyclones develop over the desert region S of the Atlas Mountains. They usually move NE upon reaching the Tunisia/Gulf of Gabes region, but may continue moving E just S of the N African coast. Since various tracks are possible, it can be very difficult to forecast when and if a N African cyclone will affect the E Mediterranean. Of special concern to the forecaster in the E Mediterranean are the desert depressions that move E just S of the N African coast during spring. The systems are hard to track because of the scarcity of timely surface data over N Africa. If the depressions deepen, they are likely to move NE.

REFERENCES

Biel, Erwin R., 1946: Climatology of the Mediterranean Area. The University of Chicago Press, Chicago, Illinois.

Brody, L.R. and M.J.R. Nestor, 1980: Regional Forecasting Aids for the Mediterranean Basin, NAVENVPREDRSCHFAC Technical Report TR80-10. Naval Oceanographic and Atmospheric Research Laboratory, Atmospheric Directorate*, Monterey, CA 93943-5006.

FICEURLANT, 1984 (Reissued 1987): Port Directory for Larnaca, Cyprus. Fleet Intelligence Center Europe and Atlantic, Norfolk, VA.

PORT VISIT INFORMATION

May 1990: NOARL Meteorologists R. Fett and R. Miller met with Port Officer and Pilot, Capt. D. Petrov to obtain much of the information included in this port evaluation.

---

* Formerly the Naval Environmental Prediction Research Facility.

APPENDIX A

General Purpose Oceanographic Information

This section provides some general definitions regarding waves and is extracted from H.O. Pub. No. 603, Practical Methods for Observing and Forecasting Ocean Waves (Pierson, Neumann, and James, 1955).

Definitions

Waves that are being generated by local winds are called "SEA". WAVES that have traveled out of the generating area are known as "SWELL". Seas are chaotic in period, height and direction while swell approaches a simple sine wave pattern as its distance from the generating area increases. An in-between state exists for a few hundred miles outside the generating area and is a condition that reflects parts of both of the above definitions. In the Mediterranean area, because its fetches and open sea expanses are limited, SEA or IN-BETWEEN conditions will prevail. The "SIGNIFICANT WAVE HEIGHT" is defined as the average value of the heights of the one-third highest waves. PERIOD and WAVE LENGTH refer to the time between passage of, and distances between, two successive crests on the sea surface. The FREQUENCY is the reciprocal of the period ($f = 1/T$); therefore as the period increases the frequency decreases. Waves result from the transfer of energy from the wind to the sea surface. The area over which the wind blows is known as the FETCH, and the length of time that the wind has blown is the DURATION. The characteristics of waves (height, length, and period) depend on the duration, fetch, and velocity of the wind. There is a continuous generation of small short waves from the time the wind starts until it stops. With continual transfer of energy from the wind to the sea surface the waves grow with the older waves leading the growth and spreading the energy over a greater range of frequencies. Throughout the growth cycle a SPECTRUM of ocean waves is being developed.

A Beaufort Scale table with related wave effects is shown on the following page.

BEAUFORT SCALE

Beaufort Number	Wind Speed Knots	Wind Speed MPH	Seaman's term	Effects observed at sea	Term and height of Waves in meters
0	Under 1	Under 1	Calm	Sea like mirror.	Calm, glassy, 0
1	1-3	1-3	Light air	Ripples with appearance of scales; no foam crests.	
2	4-6	4-7	Light breeze	Small wavelets; crests of glassy appearance, not breaking	Rippled, less than 0.5
3	7-10	8-12	Gentle breeze	Large wavelets; crests begin to break; scattered whitecaps.	Smooth, 0.5
4	11-16	13-18	Moderate breeze	Small waves, becoming longer; numerous whitecaps.	Slight, 1.0
5	17-21	19-24	Fresh breeze	Moderate waves, taking longer form; many whitecaps; some spray.	Moderate, 1.0-2.5
6	22-27	25-31	Strong breeze	Larger waves forming; whitecaps everywhere; more spray.	Rough, 2.5-4.0
7	28-33	32-38	Moderate gale	Sea heaps up; white foam from breaking waves begins to be blown up in streaks.	
8	34-40	39-46	Fresh gale	Moderate high waves; edges of crests begin to break; foam is blown in steaks.	Very rough, 4.0-6.0
9	41-47	47-54	Strong gale	High waves; sea begins to roll; dense streaks of foam; spray may reduce visibility.	
10	48-55	55-63	Whole gale	Very high waves with overhanging crests; sea takes white appearance as foam is blown in very dense streaks; rolling is heavy and visibility reduced.	High, 6.0-9.0
11	56-63	64-72	Storm	Exceptionally high waves; sea covered with white foam patches; visibility still more reduced.	Very high, 9.0-13.5
12 13 14 15 16 17	64-71 72-80 81-89 90-99 100-108 109-118	73-82 83-92 93-103 104-114 115-125 126-136	Hurricane	Air filled with foam; sea completely white with driving spray; visibility greatly reduced. Winds of force 12 and above very rarely experienced on land; usually accompanied by widespread damage.	Phenomenal, greater than 13.5

DISTRIBUTION

SNDL

21A1	CINCLANTFLT
21A3	CINCUSNAVEUR
22A1	COMSECONDFLT
22A3	COMSIXTHFLT
23B3	Special Force Commander EUR
24A1	Naval Air Force Commander LANT
24D1	Surface Force Commander LANT
24E	Mine Warfare Command
24G1	Submarine Force Commander LANT
26QQ1	Special Warfare Group LANT
28A1	Carrier Group LANT (2)
28B1	Cruiser-Destroyer Group LANT (2)
28D1	Destroyer Squadron LANT (2)
28J1	Service Group and Squadron LANT (2)
28K1	Submarine Group and Squadron LANT
28L1	Amphibious Squadron LANT (2)
29A1	Guided Missile Cruiser LANT
29B1	Aircraft Carrier LANT
29D1	Destroyer LANT (DO 931/945 Class)
29E1	Destroyer LANT (DO 963 Class)
29F1	Guided Missile Destroyer LANT
29G1	Guided Missile Frigate (LANT)
29I1	Frigate LANT (FF 1098)
29J1	Frigate LANT (FF 1040/1051 Class)
29K1	Frigate LANT (FF 1052/1077 Class)
29L1	Frigate LANT (FF 1078/1097 Class)
29N1	Submarine LANT #SSN)
29Q	Submarine LANT SSBN
29R1	Battleship Lant (2)
29AA1	Guided Missile Frigate LANT (FFG 7)
29BB1	Guided Missile Destroyer (DDG 993)
31A1	Amphibious Command Ship LANT (2)
31B1	Amphibious Cargo Ship LANT
31G1	Amphibious Transport Ship LANT
31H1	Amphibious Assault Ship LANT (2)
31I1	Dock Landing Ship LANT
31J1	Dock Landing Ship LANT
31M1	Tank Landing Ship LANT
32A1	Destroyer Tender LANT
32C1	Ammunition Ship LANT
32G1	Combat Store Ship LANT
32H1	Fast Combat Support Ship LANT
32N1	Oiler LANT
32Q1	Replenishment Oiler LANT
32S1	Repair Ship LANT
32X1	Salvage Ship LANT

32DD1	Submarine Tender LANT
32EE1	Submarine Rescue Ship LANT
32KK	Miscellaneous Command Ship
32QQ1	Salvage and Rescue Ship LANT
32TT	Auxiliary Aircraft Landing Training Ship
42N1	Air Anti-Submarine Squadron VS LANT
42P1	Patrol Wing and Squadron LANT
42BB1	Helicopter Anti-Submarine Squadron HS LANT
42CC1	Helicopter Anti-Submarine Squadron Light HSL LANT
C40	Monterey, Naples, Sigonella and Souda Bay only
FD2	Oceanographic Office - NAVOCEANO
FD3	Fleet Numerical Oceanography Center - FLENUMOCEANCEN
FD4	Oceanography Center - NAVEASTOCEANCEN
FD5	Oceanography Command Center - COMNAVOCEANCOM (Rota)

copy to:

21A2	CINCPACFLT
22A2	Fleet Commander PAC
24F	Logistics Command
24H1	Fleet Training Command LANT
28A2	Carrier Group PAC (2)
29B2	Aircraft Carrier PAC (2)
29R2	Battleships PAC (2)
31A2	Amphibious Command Ship PAC (2)
31H2	Amphibious Assault Ship PAC (2)
FA2	Fleet Intelligence Center
FC14	Air Station NAVEUR
FD1	Oceanography Command
USDAO	France, Israel, Italy and Spain

USCINCENT
Attn: Weather Div. (CCJ3-W)
MacDill AFB, FL 33608-7001

Chief of Naval Research
Library, Code 01232L
Ballston Tower #1
800 Quincy St.
Arlington, VA 22217-5000

Office of Naval Research
Code 1122 MM, Marine Meteo.
Arlington, VA 22217-5000

Commandant
Hdq. U.S. Marine Corps
Washington, DC 20380

Officer in Charge
NAVOCEANCOMDET
Naval Educ. & Trng. Center
Newport, RI 02841-5000

Commanding Officer
Naval Research Lab
Attn: Library, Code 2620
Washington, DC 20390

Chairman
Oceanography Dept.
U.S. Naval Academy
Annapolis, MD 21402

NAVPGSCOL
Meteorology Dept. Code 63
Monterey, CA 93943-5000

Naval War College
Attn: Geophys. Officer
NAVOPS Dept.
Newport, RI 02841

COMSPAWARSYSCOM
Code 3213, Navy Dept.
Washington, DC 20363-5100

USAFETAC/TS
Scott AFB, IL 62225

Commanding Officer
USCG Rsch. & Dev. Center
Groton, CT 06340

NOARL
Attn: Code 125P
SSC, MS 39529-5004

NOARL
Attn: Code 125L (10)
SSC, MS 39529-5004

Commander
Coastal Eng. Rsch. Cen
Kingman Bldg.
Ft. Belvoir, VA 22060

Central Intelligence Agency
Attn: OCR Standard Dist.
Washington, DC 20505

Defense Logistics Studies
Information Exchange
Army Logistics Manage. Cen.
Ft. Lee, VA 23801

Commanding Officer
USCG RESTRACEN
Yorktown, VA 23690

NOAA
Oceanographic Servs. Div.
6010 Executive Blvd.
Rockville, MD 20852

National Climatic Center
Attn: L. Preston D542X2
Federal Bldg. - Library
Asheville, NC 28801

NOAA Rsch. Facilities Center
P.O. Box 520197
Miami, FL 33152

Chief, International Affairs
National Weather Service
8060 13th Street
Silver Spring, MD 20910

Scripps Institution of
Oceanography Library
Documents/Reports Section
La Jolla, CA 92037

Oceanroutes, Inc.
680 W. Maude Ave.
Sunnyvale, CA 94086-3518

Istituto Universitario Navale
Facilta Di Scienze Nautiche
Istituto Di Meteorolgia E
Oceanografia, 80133 Napoli
Via Amm, Acton, 38 Italy

NOARL-W
Attn: D. Perryman
Monterey, CA 93943-5006

Director, Institute of
Physical Oceanography
Haraldsgade 6
2200 Copenhagen N.
Denmark

The British Library
Science Reference Library (A)
25 Southampton Bldgs.
Chancery Lane
London WC2A IAW

Commander in Chief
Attn: Staff Meteorologist &
Oceanography Officer
Northwood, Middlesex HA6 3HP
England

Meteorologie Nationale
SMM/Documentation
2, Avenue Rapp
75340 Paris Cedex 07
France

Meteorologie Nationale
1 Quai Branly
75, Paris (7)
France

Ozeanographische
Forschungsantalt Bundeswehr
Lornsenstrasse 7, Kiel
Federal Republic of Germany

Institut fur Meereskunde Der
Universitat Hamburg
Heimhuderstrasse 71
2000 Hamburg 13
Federal Republic of Germany

Consiglio Nazionale Delle
Ricerche
Istituto Talassografico Di
Trieste, Viale R. Gessi 2
34123 Trieste, Italy

Centro Nazionale Di Meteorolo.
E Climatologia Aeronautica
Piazzale Degli Archivi 34
00144 Roma, Italy

Director, SACLANT ASW
Research Centre
Viale San Bartolomeo, 400
I-19026 La Spezia, Italy

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. Agency Use Only *(Leave blank).*	2. Report Date.	3. Report Type and Dates Covered.
	June 1991	Final

4. Title and Subtitle.
Severe Weather Guide - Mediterranean Ports - 37. Larnaca

5. Funding Numbers.
Program Element No. O&M,N
Project No. --
Task No. --
Accession No. DN656794

6. Author(s).
R.E. Englebretson and R.D. Gilmore (SAIC)
D.C. Perryman (NOARL)

7. Performing Organization Name(s) and Address(es).
Science Applications International Corporation (SAIC)
205 Montecito Ave., Monterey, CA 93940

Naval Oceanographic and Atmospheric Research Laboratory,
Atmospheric Directorate, Monterey, CA 93943-5006

8. Performing Organization Report Number.
NOARL Technical Note 113

9. Sponsoring/Monitoring Agency Name(s) and Address(es).
Naval Oceanography Command
Stennis Space Center, MS 39529-5000

10. Sponsoring/Monitoring Agency Report Number.
NOARL Technical Note 113

11. Supplementary Notes.

12a. Distribution/Availability Statement.
Approved for public release; distribution is unlimited.

12b. Distribution Code.

13. Abstract *(Maximum 200 words).*

This handbook for the port of Larnaca, one in a series of severe weather guides for Mediterranean ports, provides decision-making guidance for ship captains whose vessels are threatened by actual or forecast strong winds, high seas, restricted visibility or thunderstorms in the port vicinity. Causes and effects of such hazardous conditions are discussed. Precautionary or evasive actions are suggested for various vessel situations. The handbook is organized in four sections for ready reference: general guidance on handbook content and use; a quick-look captain's summary; a more detailed review of general information on environmental conditions; and an appendix that provides oceanographic information.

14. Subject Terms.
Storm haven
Larnaca port
Mediterranean meteorology
Mediterranean oceanography

15. Number of Pages.
64

16. Price Code.

17. Security Classification of Report.	18. Security Classification of This Page.	19. Security Classification of Abstract.	20. Limitation of Abstract.
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	Same as report